The Chemical Age

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Notes and Comments

British Fuel Problems

IT is perhaps a curious circumstance that the home production of oil has not attracted the great oil companies, but has been left to the chemical industry. The result has been essentially to bring the oil and chemical industries into mild opposition. The retiring president of the Institute of Fuel, Sir Harry McGowan, represents the synthetic production of oil from coal; the new president, Sir John Cadman, typifies the oil interests. It was consequently, of no little interest to hear what Sir John, standing by the side of the chairman of Imperial Chemical Industries, Ltd., had to say in his presidential address to the Institute about the relative positions of coal and oil in British fuel policy. Disentangled from his interesting historical survey of the Government's treatment of the fuel industries, the facts as set forth in Sir John Cadman's address are these. The output of coal has declined from 287 million tons in 1913 to 221 million tons in 1934, primarily as the result of increased thermal efficiency of fuel utilisation and of the loss of export markets. The total fuel oil used in this country is below 1 per cent. of the total fuel consumed, if the internal combustion engine—not in any event fired by coal—is left out of the picture. Sir John seems to be quite satisfied that the coal industry should dwindle and continue to dwindle even though it means leaving much valuable coal in the ground for ever because it will pay to work only the cream of the mines. He believes that the fact that new industries have sprung up is a satisfactory reason for discarding the old fundamental industries. Very rightly he maintains that the aim of British policy towards fuel should be to give British manufacturers every advantage that can be obtained from ample supplies of cheap fuel. From this it is but a step to say that if oil fuel be cheaper than coal it should be allowed free entry into the country in unlimited quantities. Strictly, this reasoning can only be sound when applied to industries wherein fuel costs are a predominant part of the total costs of production.

Parliament, having considered the problem carefully, has come to the conclusion that we cannot afford to allow so basic an industry as that of coal mining to collapse. New processes have been devised to enable coal to be converted into oils. The market for oils is large and is growing. The total consumption of motor spirit in this country has advanced from 360,000 tons in 1913 to 2,136,000 tons in 1926; from 3,432,000 tons in 1930 to 4,178,000 tons in 1934. The total tonnage of oil of all sorts used was nearly 8½ million tons in 1934 and is growing rapidly; that is the field for oil production. A prominent coal-owner said the other day that new uses for coal are imperative, and that the coal-owners' best opportunity for expansion lay in the development of new processes which would make coal and coal products into the raw material for other industries. In other words the coal industry, after a long period during which the utilisation of coal was neglected, is now turning hopefully to the chemist. Recent articles in THE CHEMICAL AGE have shown that the chemist is already responding to the call. The great task that now lies before him is not so much to produce the oils, as to reduce the cost of production so that users will not be handicapped by comparison with their foreign, oil-using competitors. Research has not yet said its last word.

Safety in the Chemical Industry

THERE is no more useful branch of the activities of the Association of British Chemical Manufacturers than that concerned with the promotion of safety in chemical works, and we are glad to learn from the report presented at the annual meeting last week that this work has been vigorously continued during the past twelve months under the direction of the Works Technical Committee. In addition to its quarterly Safety Summary, the Association has issued during the year seven safety circulars on accidents or occurrences which teach a useful lesson. An investigation—to which the Association is contributing half the cost—of the problem of devising tests for the detection of low concentrations of toxic gases that are likely to be met in industry is nearing completion. Methods of detection and estimation, in most cases involving the use of test papers, have been worked out and standardised by the Chemical Defence Research Department in respect of hydrogen sulphide, arsine, sulphur dioxide, nitrous fumes, organic halogen compounds, aniline, hydrogen cyanide, chlorine, carbon disulphide and carbon monoxide, while the work on benzene, nitrobenzene, and phosgene is nearing completion. Tests of a number of these methods under works conditions are being carried out by various members of the Association. Meanwhile the problem of reproducing the standard stains has been investigated and a printing method has been found which will give consistent results and produce stains of a permanent nature. A further problem which the Association has agreed to support financially, relates to the testing of respirators for industrial use, to ensure that they will give adequate protection against all the gases for which they are recommended. The problem is a complex one and experience has indicated the weaknesses of the existing methods. The work is being done by the

Chemical Defence Research Department, which has a unique knowledge of respirator testing, and good progress is being made.

Experiences in the Navy in extinguishing fires have raised suspicions in certain quarters as to the safety of carbon tetrachloride fire extinguishers. While the evidence was not sufficient to prove the suspicions to be well founded, it was felt that a complete physiological investigation of the subject would be useful, and the Chemical Defence Research Department has undertaken to draft a suitable programme of tests, which will include a methyl bromide, as well as carbon tetrachloride, fire extinguishers.

Voluntary Efforts to Reduce Accidents

IN connection with the voluntary efforts which each industry is making, at the request of the Home Office, to reduce accidents, the Chemical and Allied Employers' Federation, some three years ago, undertook the regular collection and investigation of accident statistics supplied by its members. At the request of the council, many members of the Association of British Chemical Manufacturers, who did not belong to the Federation, agreed to supply similar statistics so that a comprehensive survey of the chemical industry could be obtained. The Federation has now come to the conclusion that this work could be more conveniently done by the Association as part of its normal safety activities, on the ground that safety is a technical and production matter rather than a labour problem, and with this the Council has agreed. The Federation has undertaken to make a contribution towards the cost involved. The Works Technical Committee will examine the collated statistics and take such action as appears necessary to obviate accidents that could be avoided; it will also continue to work in the closest co-operation with the Federation.

A number of problems of a medical nature have recently arisen in connection with the Association's safety activities, and more will arise from the examination of the accident statistics referred to above. It has therefore been decided to form a medical sub-committee of the Works Technical Committee, and a number of firms who employ medical officers have agreed that these officers should serve on the new sub-committee. The sub-committee will devote its attention to medical problems peculiar to the chemical industry and will not overlap with the work of any other organisation. The first meeting of the sub-committee will be convened as soon as a tentative programme of work has been drafted. The Works Technical Committee has come to the conclusion that more attention to safety considerations is desirable in the training of chemists.

Methods of the Inventor

TO-DAY, the research worker takes the eye; the inventor is apt to be neglected. Disregarding the inventions made as the result of a "brain-wave," most worth-while major inventions, however, arise from research. It may or may not be the type of investigation we term "scientific research," but at least it involves conscious trial of a greater or less number of methods in order to solve a known problem. Much research, and nearly all research into pure science, involves altruistic investigation without thought of commercial application. Before the stage of commercial application is reached, the hand of the inventor must touch the work of the pure investigator and quicken it into life. A visit to the International Exhibition of Inventions, recently held in London, brought to mind a recent book on Edison ("Edison: His Life, His Work, His Genius," by W. A. Simonds), which is well worth reading for its insight into the mental processes of one who was at the same time a research worker and an inventor.

Edison was more interested in work for its own sake than in the financial results; the scientific man who works to gain money is seldom anywhere near the front rank of his profession—work for the joy of working must come first. Thus on one occasion he decided to ask £1,000 for an invention, but not liking to put forward this figure asked for an offer; he was offered £8,000. For a telephone improvement he decided that £5,000 was ample, but again asked for an offer and was given £20,000. To a cable from Britain asking his price for making a special type of receiver he replied "Thirty thousand," meaning dollars—he was paid in pounds. And so it went on, this man "whose contributions to industrial science were so many and so important that he seems to have been concerned in almost every mechanical development of the art of living during the last sixty years" did not live for money nor think much about it; his whole being was centred in his work, not in the material advantages to himself. When he lost £350,000 on his steel works, he could say philosophically, "Well, we had a hell of a good time spending it."

The General Election

THE General Election in November is now accepted as certain. Under the terms of the Parliament Act there must be an appeal to the country within the next few months, and the only alternative dates are apparently January or May of next year. There is some criticism in political circles, hostile to the Government, of a November election. The business community, as such, has no concern with the calculation of possible party gains and losses. The two considerations which chiefly appeal to it are that Government should be orderly and stable, and that the general election should be held at a time when there would be the least possible chance of a dislocation of trade. From both these there are strong arguments for facing the inevitable as quickly as possible. There has been an observable tendency for several weeks for the consideration of major commitments to be put off until the democratic cat has shown the way it is going to jump, and the sooner manufacturers and traders know what sort of dispensation they are going to live under in the immediate future, the better it will be not only for them, but for the great army of employees dependent upon their enterprise. Again, from a purely trading point of view, mid-November would probably be a less inconvenient time for the election, than any of the early months of the New Year. In an ideal State, business would be conducted as usual during an election, and in any event British common sense has greatly reduced the commotion which used to accompany a general election. There is no practical reason why a single order should be held up, or a single workman displaced, because a normal act of citizenship is being discharged by the nation.

Coal Hydrogenation Petrol Plant

Official Opening at Billingham by Mr. Ramsay Macdonald

MR. RAMSAY MACDONALD formally opened the coal hydrogenation petrol plant at the Billingham works of Imperial Chemical Industries, Ltd., the first in the world for the hydrogenation of bituminous coal, on Tuesday afternoon, in the presence of Professor F. K. R. Bergius, the inventor of the hydrogenation process, and an assembly of over three hundred distinguished guests. The plant has actually been in operation for some months, and has to date converted over 11,000 tons of coal into petrol. Mr. Macdonald marked the occasion of his visit by pressing a button to operate a tippler which transferred a load of coal from a wagon to a conveyor on its way through the complicated process of conversion into motor spirit. The guests travelled from London to Middlesbrough by special train and were entertained to luncheon at the Middlesbrough Town Hall before touring the works.

The official visit was preceded by a Press tour of the works, conducted by Mr. F. E. Smith, chief engineer at Billingham, who explained that the new plant to be opened that day covered an area of forty acres out of the total area of 800 acres of the Billingham works. This section, however, covered only a small part of the process, and did not include such essential services as the supply of steam and electricity or the production of hydrogen, which came from other parts of the site. The essential point of the whole process, said Mr. Smith, was that they had already developed at Billingham the technique of hydrogenation for the production of ammonia. The Billinham factory was originally built as a fertiliser factory, and having already developed the technique for high pressure work, it was only a short step to deal with the hydrogenation of coal. Since the company started work on hydrogenation in 1927 it had spent over a million pounds on continuous research work on that one subject, and in 1930 1931 it installed a small plant treating some 15 tons of coal per day. That trial plant proved that the scheme was commercially possible.

The Hydrocarbon Production Act passed last year gave the company some guarantee that it might get a reasonable return on the process, but it was desirable to remove a popular misconception in regard to the provisions of that Act. He had met people who had a vague idea that Imperial Chemical Industries, Ltd., were receiving some special treatment. The fact was that the company had no more and no less than any other concern engaged in the home production of oil. The Act simply gave a preference to home-produced oils, and did not entail a subsidy. The whole of the capital for the plant had been found by Imperial Chemical Industries, Ltd., which stood the whole risk associated with the undertaking.

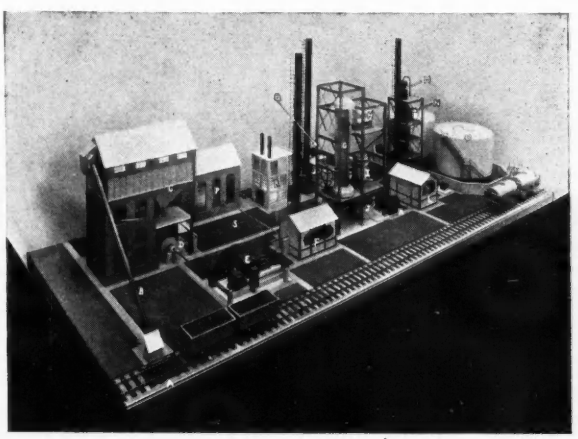
Mr. Smith paid a special tribute to the contractors who had been concerned in the erection of the plant, especially the heavy steel industry. The heavy steel forging makers had entered into their requirements absolutely wholeheartedly. They demanded from them steels that were new, involving very great difficulties in manufacture, and they came up to scratch in a most amazing way. They had worked hand in glove and the results had exceeded their expectations. Equal praise was due to all the other contractors who had worked their hardest to complete the plant in what everyone considered was record time. They completed the first unit in just eighteen months, and the whole plant was completed in two or three months after that. When it was remembered that to do this work meant making, on their own part, something like 6,000 drawings, and that a lot of the technique was new, not only to themselves, but to the contractors, it would be realised that it had involved a very great effort on everybody's part.

The accomplishment of such an undertaking tended to keep this country in the forefront of technical progress. When they first built the ammonia plant and went from low pressures to high pressures they thought they had achieved a big step, but it had been a much bigger step to introduce the high temperature now being employed in the hydrogenation of coal. The plant on the actual new site had cost two millions, in addition to which large sums had been expended on other parts of the site, and they were using other plant already erected. The petrol was supplied in bulk to the major oil companies, and they left it to them to distribute it as they thought best.

In answer to questions, Mr. Smith said the petrol was not being sold under a special name, and no one could walk into a filling station and ask specifically for Billingham petrol.

How the Process Works

THIS model is intended to show, in simplest form, the main features of a plant hydrogenating coal to make motor spirit. It is not intended to represent closely either the Billingham plant itself or the entire process as operated commercially. The process is represented as being carried out in one stage in place of the three actually employed, and many details, such as heat exchanges, are omitted entirely.



Clean coal is fed into the hopper (A) and taken by conveyor (B) to storage bunkers (C). The coal is then fed to the grinding mills (D), where it is mixed with heavy oil, returned (along a pipe S) from a subsequent stage of the process, and the whole ground into a fine paste consisting of 50% of coal and 50% of oil.

High pressure paste injectors, (E), force this paste against a pressure of 3,700 lb. per sq. in. (250 atmospheres) into the convertor system, and at this point it joins the hydrogen, which has been manufactured, purified and compressed in the plant (P). The two are heated together in the preheater (F) to the reaction temperature of 450° C. The reaction takes place in the special heavy steel forging, or convertor (G). Most of the products and gas pass overhead from the convertor through a cooler (H) to a catchpot (I) where the condensed mixed oils separate from the uncondensed gases. The former are collected in a tank (J) and pumped (K) to a distillation plant where they are heated in the furnace, (L) and fractioned in a column, (M). Petrol is distilled off, is condensed in a cooler (N) and, after very limited refining, stored in tanks (O), ready for shipment in tankers or rail tanks.

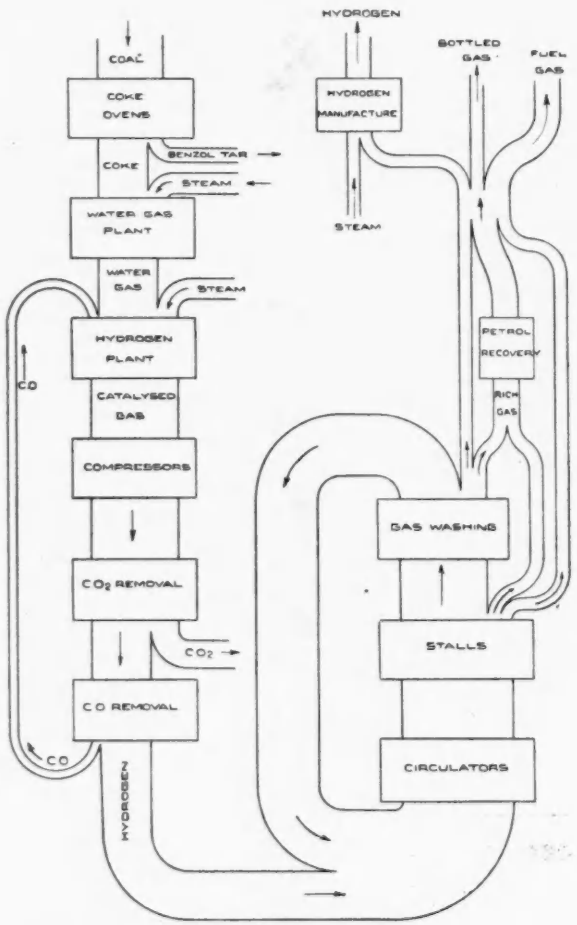
The heavy fractions (S) are returned to the process, part being used as pasting oil in the coal mills (D) and the remainder hydrogenated further so that only petrol is finally produced.

Going back to the converter (G), a heavy residual sludge including all the coal ash is purged off the bottom of the system and passed to a sludge plant (R), where as much oil is recovered as possible and the remainder made into solid fuel for burning under boilers.

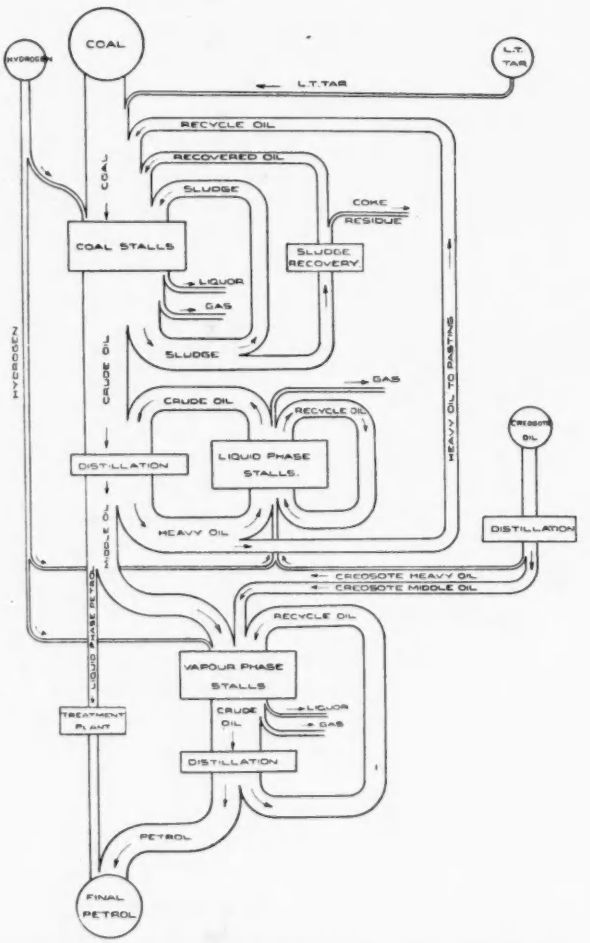
The uncondensed gases separated in the catchpot vessel (I) are treated to recover all the available hydrogen and the balance, consisting chiefly of hydrocarbon gas, returned to the hydrogen plant (P) as a source of further hydrogen for use in the process.

Nearly 40,000 metric tons of petrol had been dispatched from Billingham to date. They were making about 400 tons per day, representing a total annual output of 45,000,000 gallons. Taking the whole process into cconsideration, they used about four tons of coal to produce one ton of petrol.

The opening of the new plant is one of the most important industrial events that has taken place in the United Kingdom for many years. It marks the start of a completely new British industry. The hydrogenation proccess is a revolution in fuel technology. The hydrogenation of coal is a self-contained process as the only raw materials are coal and water, and, if desired, petrol can be the sole end product. Flexibility is a valuable feature, as tars and petroleum can be treated and the conditions arranged to give fuel oil, diesel oil, petrol and liquefiable hydrocarbon gases such as propane and butane. Hydrogenation makes it technically possible to render this country independent of imported oil supplies (with the exception, at present, of lubricating oil). It is a great



Flow diagram of hydrogen production and treatment of hydrogenation plant gases.



Flow diagram of plant for the hydrogenation of coal, creosote oil and low temperature tar.

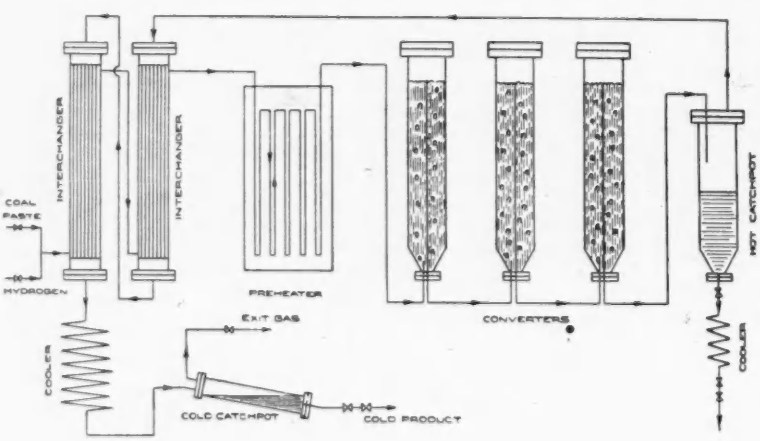
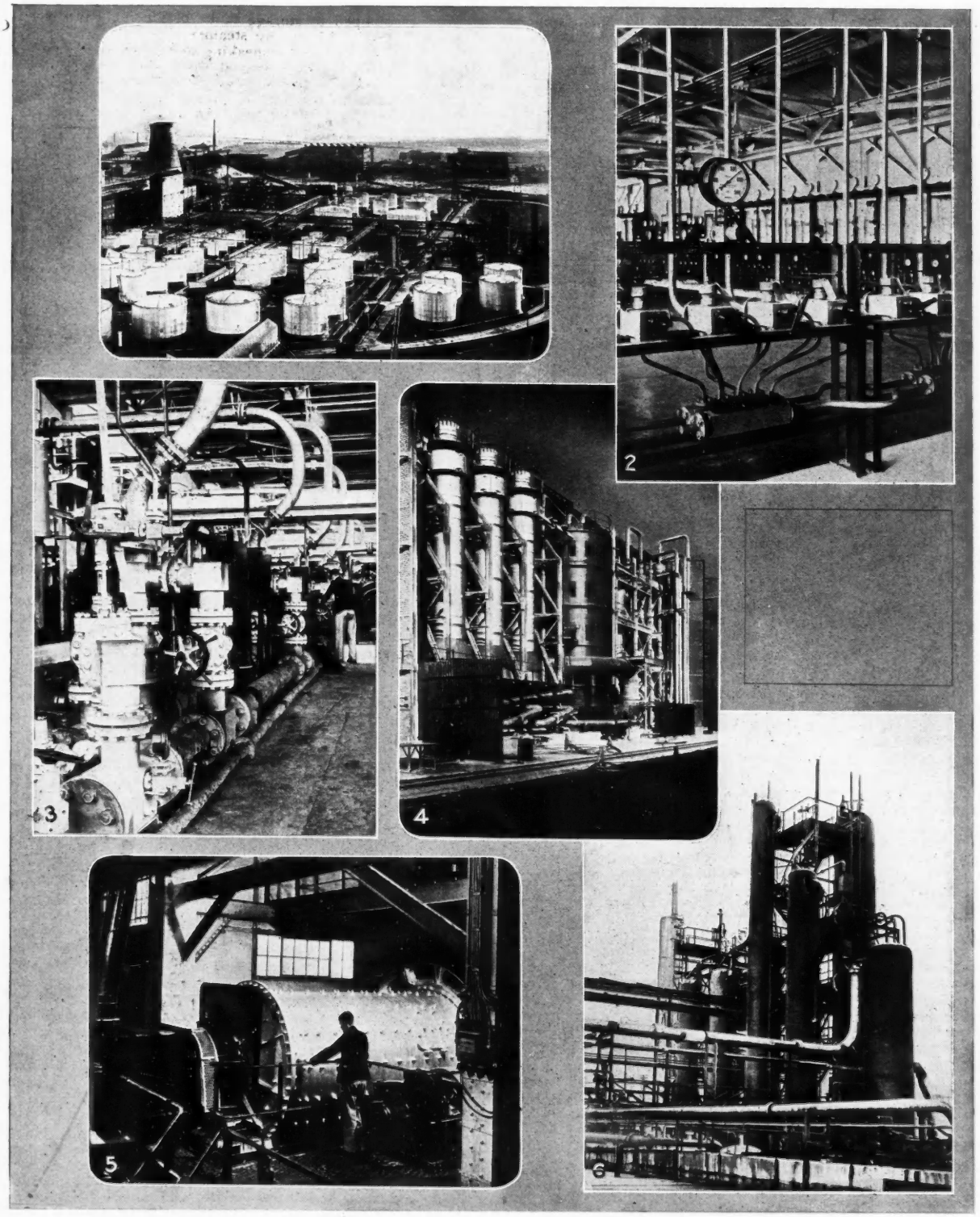


Diagram of full scale hydrogenation unit.

technical advantage to operate in units of a size comparable with those in the Billingham plant, because of the complicated nature of the process. Although the unit size is large and the capital cost correspondingly high, this cost compares favourably with that of other methods of making oil from coal, when calculated on the basis of liquid fuel output. The Billingham plant makes only four per cent. of the country's consumption of petrol, but its output is nearly as large as that of all the other home sources of motor spirit from coal added together, such as benzol from gasworks and coke ovens, low-temperature carbonisation and so on.

Petrol contains 85 per cent. carbon and 15 per cent. hydrogen, whereas in coal 85 parts of carbon are associated with only 5 parts of hydrogen. In the hydrogenation process coal is treated under pressure with hydrogen, so that solid coal is transformed nearly quantitatively into petrol and gaseous hydrocarbons. The yield of petrol is be-



Coal Hydrogenation Petrol Plant at Billingham

1.—A " tank farm " for the storage of intermediate oils and finished petrol. The tanks are painted with special paint to reflect heat. 2.—A feature of the plant is the delicate instruments used for the fine control of high pressures. 3.—Pipes and valves associated with the injection of coal paste to the converters. 4.—High pressure converters where the coal is hydrogenated. 5.—One of the mills for grinding the coal to fine paste necessary to secure its hydrogenation. 6.—Distillation section of the Billingham plant.

tween 60 and 70 per cent. by weight. Low-temperature tar and creosote oil contain between 85 per cent. and 90 per cent. of carbon and between 7 and 8 per cent. of hydrogen. They can be hydrogenated into petrol with a yield of between 80 and 90 per cent. The hydrogen is made by the decomposition of steam by means either of coke or the residual hydrocarbon gases from the process.

I.C.I. Research Work

Research work by I.C.I. has been continuous since 1927. In 1931 an agreement was made with the other operators in the hydrogenation field, the I.G. of Germany, the Standard Oil Co. of New Jersey, and the Royal-Dutch-Shell Co., resulting in the formation of the International Hydrogenation Patents Co. to pool patent rights and to exchange technical information. Arrangements were made at the same time for marketing production through existing oil companies. In 1933 the Government announced the British Hydrocarbon Oils Production Bill, which guaranteed a preference on home-produced light oils for a period of years. The period from April, 1935, is 4½ years if the preference remains at the present figure of 8d. a gal., 9 years if the preference drops to the guaranteed minimum of 4d. a gal., and in proportion for other amounts of preference. The plant at Billingham was authorised immediately and construction started in August, 1933. It was originally intended to produce 100,000 tons a year of petrol from coal. It was later decided to increase the capacity to 150,000 tons a year of petrol, the extra 50,000 tons to be made either from coal or creosote oil and low-temperature tar. The first section was ready in January, 1935. Creosote oil was used as the starting material, and the first petrol was made in February. The first coal unit was started in June, and the output is expected to reach the designed figure before the end of this year. The normal rate of production is 410 tons, or 123,000 gals. of petrol a day (one ton of petrol is 300 gals.).

During the erection of the petrol plant the total numbers employed at the works rose from 7,000 to a peak of 13,600, almost entirely on account of construction work. There was still greater additional employment at contractors' works where the various forgings and machines were made. New capital expenditure amounted to £3,000,000, which corresponds to the employment of 9,000 men for eighteen months. Of the 9,500 workmen now in normal employment at Billingham, about 2,000 are engaged on the manufacture of petrol, and necessary services and research. The extra coal consumption corresponds to the employment of 2,000 miners. The plant took about eighteen months to build, and except for a few special instruments the whole was made in the United Kingdom. Special materials, never before employed in this country, were used.

An Outline of the Process

The raw coal is cleaned to less than 2½ per cent. of ash and is ground up with oil previously made in the process, to make a 50 per cent. coal-in-oil "paste." This is injected against the working pressure of 250 atmospheres (3,700 lb. per sq. in.) and mixed with hydrogen. The mixture is heated up to reaction temperature, and liquefaction of coal takes place at 450° C. (850° F.) and 250 atmospheres pressure. A small heavy oil fraction containing the unconverted coal (5 per cent. by weight) and ash is treated for oil recovery and the coke residue is used as a fuel. The major part of the coal is transformed into lighter oils which are vapourised, and are recovered on cooling the gaseous products leaving the converters. The crude oil so obtained is distilled into heavy oil, middle oil and petrol. Heavy oil is further hydrogenated in plant exactly similar to that used for the hydrogenation of coal, to give middle oil and petrol. Middle oil resulting from these two steps is further hydrogenated in vapour phase converters, in which the vapourised light oil and hydrogen are passed over a solid catalyst. The crude vapour phase product is distilled, the residual middle oil being separated from petrol and treated again. The whole of the coal is thus transformed into a small solid consumable residue, gas, and petrol.

Creosote oil and low-temperature tars are either employed for making up the coal paste or distilled and the fractions introduced into the liquid or vapour phase stages as appropriate. These materials play no essential part in the main process of making oil from coal, but are conveniently treated along with the coal. The final petrol, after a simple purification, is pumped to storage tanks beside the River Tees, from which it is shipped by steamers.

Mr. RAMSAY MACDONALD, speaking at the official luncheon, said that the industrial growth of the nations of the world, especially during the last century and a half, had depended on the command of fuel and power. Our vast coal deposits had put us in a fine position to play a leading part in that growth. But recently there had been two critical inventions —the internal-combustion engine and the compression-ignition engine. These had revolutionised the mechanism of power, and with it the kind of power. Coal had been dethroned by oil and had completely changed our prospects. Was the power embodied in our coal deposits to lie as idle as that in the old windmill and water dam? A little over a generation ago men of vision foresaw this eventuality and chemists began to wonder whether it was not possible in their test tubes and retorts to resurrect coal. The German chemists were the pioneers, and amongst them stood conspicuously the name of Dr. Bergius. When he was receiving the Melchett Medal from the Institute of Fuel at the end of last year he told the story of his work. As early as 1921 he had explained his ideas to the Department of Scientific and Industrial Research. In 1923, under his influence, experiments were begun by the Fuel Research Station. The result was that the Government gave a subsidy to enable the necessary research to be prosecuted. In 1927 the experiments were taken over by Imperial Chemical Industries, Ltd.; that secured that they would be conducted on the scale, and with the expenditure, necessary for their success.

Two Practical Aspects

There were two practical aspects of this work which would appeal to the country at the present moment. One was employment, and the other defence. In the construction of the plant employment rose from 7,000 to a peak of 13,600, not taking into account the work provided by the contractors. The expenditure of three million pounds had provided for 9,000 men an equivalent of eighteen months' work. It was estimated that the plant would give work for 1,000 men on itself, and at least for another 1,000 on its immediate requirements. It would consume 600,000 tons of coal per annum. and that meant employment for 2,000 miners. Nor would Billingham remain unique as it was to-day. There would be other developments, more plant and further extensions, both of works and of processes; and that would mean more work for miners, more work for the iron and steel industry, more work for engineers—three trades absolutely essential to the well-being of this country.

Then as regards defence. There was a hullabaloo about armaments, warlike designs, and so on. So far as he was concerned he was enlisted for peace, and he had no trust in arms for the prevention of war. But defence and the requirements of defence were quite a different matter. In the present state of the world the nation that could defend itself was a nation that could use every particle of its influence for peace. The Government could defend itself if challenged. The Government had been examining its present capacity to keep an aggressor at arm's length, should he appear. Not one Government or Party, but all Governments and Parties that had been in power in this country for some years had been reducing our armaments, and the conclusion had been reached that, in relation to the state of the world, we had gone too far and had decided that our defence equipment required to be made good. A command of oil was essential for our defence. Of course we could import it and store it, but that would be rather awkward for our balance of trade. It might also be awkward to provide a supply in case of war. The prospects of finding oil in our own strata were not very bright, but it would be comforting to know that at a push we could manufacture it within our own borders; and no one could say that in doing so we were menacing or provoking other countries to attack us. The production for a long time to come might be rather in the nature of a supplement than of a maiden supply, but still the supplement would increase, he hoped, in its quantity.

There was no rivalry at all between producing companies, and the oil distributing companies. That, indeed, would be a great calamity. Imperial Chemical Industries, Ltd., had arranged with the distributing companies—Shell Mex, B.P., and the Anglo-American—to distribute its products. He congratulated them on the arrangement, and recognised the help that the distributing companies had given.

SIR HARRY MCGOWAN, in reply, said that Lord Reading,

president of the company, had asked him to express his regret at his absence, due to his recent illness. He was also sorry that they were unable to welcome Captain Cruickshank, Secretary for Mines, who had taken so close an interest in this enterprise, following the encouragement given to it by his predecessor, Mr. Ernest Brown. The opening of the plant brought to a practical commencement an enterprise which had engaged their attention for many years. In was a triumph of chemical research. In his Melchett Lecture last year, Dr. Bergius described how his discovery of a method of converting coal into a material of "lower molecular weight with relatively high hydrogen content" sprang from "experience of a purely scientific nature on the formation of coal from vegetable matter."

International Co-operation

Research on such an objective could not be undertaken in the expectation that it would fructify overnight. Here it was begun in the knowledge that the furrow would be a long one, calling for a spirit that refused to acknowledge the possibility of defeat, counting and accepting the cost. In the end they spent more than a million pounds on this research. Efforts on this scale, involving the risk of such expenditure, were only within the compass of companies with substantial resources, and, moreover, of concerns moving with that freedom and elasticity peculiar to private enterprise alone. During that period they had the active encouragement of the Government and interest was displayed in their work by the Fuel Research Board, which sent a commission to the factory in 1930, and to which they disclosed all the details of their work at that time. They were not the only occupants of this research field, for similar activities were proceeding abroad though from slightly different angles. The German I.G. was at work on brown coal, the Standard Oil Co., of New Jersey, was occupied with petroleum oil, and the Shell Group were not inactive. International co-operation in enterprise had always been one of the company's guiding principles. It was, therefore, with pleasure that in 1931 they effected with these three companies a pooling of all interests in the hydrogenation process, including a provision for a complete exchange of information, which promoted a more rapid advance by bringing them into immediate touch with every development of major importance. He referred particularly to the high value they attached to the co-operation of their German friends, the I.G., and for this reason to offer a special welcome to Dr. Krauch and Dr. Pier.

Sir Harry expressed appreciation of the work of all the men, of whatever rank, who had shared in the preparatory phases leading up to the great accomplishment which this plant marked. In their ranks he included all the plant fabricators and contractors. Their own staff had had to face the complex and baffling problems of all descriptions incident to new research and a unique plant. New questions constantly confronted them, disappointments had been almost as frequent as successes, but they had never lost heart. Bit by bit, persistent, undaunted, they had faced every trouble as it had arisen, and had conquered them all. The chemists, engineers, metallurgists, draughtsmen, and workers might all be proud when they look at this plant. To name them was impossible, but without being invidious, he desired to single out Mr. Kenneth Gordon, who had been in charge of the research work and construction of the plant, and also Colonel Pollitt, who was the inspiration of their earliest efforts.

Distribution Arrangements

One problem they had been spared. Their job was to manufacture, but not to distribute. The close collaboration they had established with the great companies engaged in that task in this country freed them of that burden. Shell-Mex and B.P., Ltd., and the Anglo-American Oil Co. were responsible for the distribution of petrol produced in this plant. There was to be no waste of capital by duplication of services. While the arrangements for this purpose had given rise to numerous nice points, he was happy to say that so far every one had yielded to the solvent of friendly discussion, and he had every confidence that their present happy relations with the oil companies would prove permanent. The oil companies had dealt broadmindedly throughout with the advent of this newcomer to the sources of petrol supply.

Mr. Macdonald had referred to the national aspect of the plant. They confidently believed that it represented only a beginning. They were not depressed by the thought that its output was only 4 per cent. of the country's consumption of motor spirit. They trusted that in times of emergency—and present events sharply reminded them that they did not yet belong to the past—the production available from this plant and others which might in due course be erected, would prove not only a source of reasonable satisfaction to the company and its shareholders, but also a safe home-produced source of supply of a vital transport essential. So far as we were self-contained in petrol, to that extent our navy would be able to afford a greater measure of protection to the safe transport of food and other necessaries to these shores.

Among the principal guests were:—Professor H. E. Armstrong, Lord Ashfield, Professor W. A. Bone, Sir Christopher Clayton, Dr. W. H. Coates, Sir Edward Crowe, Professor F. G. Donnan, Mr. H. N. Gresley, Sir Richard Gregory, Col. Sir Maurice Hankey, Sir Harold Hartley, Sir Francis Joseph, Dr. C. Krauch, Dr. J. B. A. Kessler, Lord Lloyd, Dr. H. Levinstein. Sir Wm. J. Larke, The Marquess of Londonderry, Professor Henry Louis, Lord Melchett, Sir William McLintock, Sir David Milne Watson, Mr. Alistair MacDonald, Mr. Emile Mond, Mr. P. C. Pope, Dr. M. Pier, Dr. D. S. Paul, Major C. L. Pilkington, Professor H. Rainstrick, Professor E. Robinson, Sir Frank Smith, Lord Stonehaven, Lord Herbert Scott, Lord Weir, Sir Alexander Walker, and Professor R. V. Wheeler.

Cosmetic Manufacture

Use of Monel Metal and Nickel for Equipment

THE perfumes and other ingerdients used in the manufacture of cosmetics and lotions are most sensitive to contamination. Monel metal and nickel are without effect on the purity of these constituents, and plant fabricated from these metals may easily be cleaned, which is an essential requirement for equipment used in the manufacture of face creams.

In the making of cold creams the ingredients such as glycerine and borax are often processed in steam-jacketed Monel metal kettles with Monel metal fittings and valves. The mixing of oil, wax, water or perfume and colouring matter are accomplished by means of a portable mixer with Monel metal shafts and propellers. Monel metal is also extensively used in the preparation of vanishing creams which are usually stearic acid emulsified with soap. The mixture is handled in Monel metal containers and delivered to a colloid mill down chutes of the same alloy. The rotor, stator and discharge aprons of the colloid mill may conveniently be fabricated from Monel metal and the tube-filling machines may also be equipped with this metal.

Cosmetic lotions are prepared from essential oils in steam-jacketed pure nickel kettles. Nickel is preferred because it is the only metal that has no effect on the perfumes. After processing the lotions are fed into a homogeniser and from there to nickel storage tanks. From this point onwards Monel metal can be used and, in fact, is used for the pipe conveying the lotion to the bottle-filling machines which are fitted with Monel metal reservoirs and Monel metal filling and vacuum tubes.

Irish Industrial Alcohol Works

Contracts for Equipment

THE contracts for the equipping of five industrial alcohol distilleries in the Irish Free State has been awarded to the Skoda Corporation, of Pilsen, Czechoslovakia. The distilleries will be under the control of the Free State Government, and it was through official Government channels that the contract was placed. It is understood that the Skoda Corporation's biggest rival for the contract was a German firm; an English company had also tendered for the distillery equipment. Distilleries are being established at the following centres:—Riverstown, Carley, County Louth; Carrickmacross, County Dublin; Carndonagh and Corkay, County Donegal; and Corroy, near Ballina, County Mayo. Production from these distilleries, during the initial stages of development, is expected to be about 600,000 gallons of industrial alcohol per annum.

Economics of the Synthetic Manufacture of Ammonia—III

Gas Plant and By-Products

These notes were originally compiled in 1918, with the object of providing information necessary to decide whether it would be advantageous to manufacture ammonia synthetically as a commercial proposition in England. They are now published in the hope that they will prove useful to young chemical engineers, in showing the details involved in the preparation of such a scheme. The nitrogen fixation processes considered are those known as the Cyanamide, Arc and Haber processes.

Coal Supplies

Quantity of coal.—Washed Nuts	...	110 tons per day.
Quality of coal.—Carbons	...	80%
H_2	...	5.5%
O_2	...	8.8%
Nitrogen	...	1.5%
Sulphur	...	0.8%
Ash	...	3.4%
Volatiles	...	30-35%
B.T.U.	...	14,400 per lb.

Coal of above composition would, in general, be suitable.

If the coal were brought straight from the pit's mouth it would be passed to washing plant and then be graded and passed to store. The quantity of storage will depend on local conditions. The coal would be elevated from the store and conveyed mechanically to bunkers above the retorts.

Vertical Retorts v. Coke Ovens

A continuous vertical retort system has been chosen in the present instance because the quality of the coke obtained is most suitable for the production of water gas, giving a larger yield and a better quality than the coke usually obtained from coke ovens. The quantity of by-products obtained is also larger, except in the case of ammonium sulphate from coke ovens, which is only very slightly greater than that from a gas plant. The decision as to the erection of coke ovens or a vertical retort system would largely depend on the quality of coal to be obtained. Coke ovens are generally used with poorer quality of coal and have a larger output per unit of plant, but, on the other hand, greater repair costs. A vertical retort system will be considered in this case.

To gasify 110 tons of coal per 24 hours would require about 24 retorts, allowing 10 per cent. excess capacity. Four units would be arranged, each possessing six retorts in each unit or bench. Coal will be delivered from the bunkers direct into the hoppers feeding the retorts. The most suitable form of construction appears to be the Woodall Duckham type, but in this case they should be arranged for gas heating instead of heating by coke. The gas for this purpose will be supplied from an outside producer plant. The advantage of this procedure is that the whole of the coke produced from the good quality coal can then be used for the manufacture of hydrogen, while the poor quality slack coal can be used for raising gas to heat the retorts.

As about 11.5 per cent. of the original weight of fuel carbonised is required for heating a vertical retort system when employing coke firing, and as about 15.5 per cent. is required when heating with producer gas raised from the coke produced, about 4 per cent. extra coal fuel has to be burned for the same output of coke if the latter system is adopted. But as 15½ per cent. of the coal can be cheap slack coal and as the yield of by-products is much greater, there is an economical advantage on the side of the external producer, more particularly in the case where a maximum of coke is required, as for this project. The actual economy, of course, depends on the initial cost of the two qualities of coal.

Quantity of coke produced.—About 66 tons.

Quantity of gas produced.—Assuming a yield of 12,500 c.f. per ton of coal carbonised, would be 1,375,000 cu. ft. of calorific value 305 C.H.U. per cu. ft.

The quantity of gas could be increased without appreciable reduction of the quantity of coke by "steaming." This is particularly important for the production of coke of such quality suitable in this process, where water gas is desired as free as possible from methane, etc.

The steam removes the volatile matter from the coke, leaving a very porous coke which not only gives a purer but a greater yield of water gas. The quantity of gas to be expected if steaming is employed would be about 1,600,000 cu. ft., calorific value, say, 25 C.H.U.

The coke could be taken hot from the base of the retorts and conveyed direct to the water gas plant, but the saving of heat so obtained is insufficient to warrant the installation of hot coke conveyors, which are heavy on "wear and tear."

The coke from the base of the retorts is therefore water cooled on approaching the extractors in the usual manner and will be delivered to chutes arranged directly within the furnaces. These would feed a conveyor carrying and elevating the coke to the bunkers above the water gas plant. Here it would be delivered through a screen to remove the breeze into bunkers feeding direct into the water gas generators. If handled mechanically, the breeze in small coke would amount to very little: a maximum of seven per cent. may be assumed.

The total quantity of coke available for water gas products would therefore be $66 - 4.6 = 61.5$ tons.

Water Gas Plant

The quantity of water gas required is 3,700,000 c.f. at 20° C., and, as 37 lb. of coke (exclusive of breeze) may be taken to give 1,000 cu. ft.,

$$\frac{3{,}700 \times 37}{2{,}240} = 61 \text{ tons of coke are required.}$$

For good gas coke from vertical retorts this figure of 37 lb. would be easily obtained: the average is between 30 and 35 lb.

Generators of 1,000,000 cu. ft. per 24 hours would be installed. Thus four units would be necessary and one spare = five in all. (It might be found preferable to instal the first two of 1,000,000 cu. ft. size and the other two of 1,500,000 cu. ft. size.) The generators would be arranged in one row below the coke bunkers and would be fitted with control platform, clinker platform, valves, etc., complete.

Waste heat boilers would be fitted to raise steam from the heat of the "blow" gases and the "make" gas.

The generators would be hand clinkered, unless some satisfactory form of mechanical clinkering could be obtained. The coke produced as described should lead to little trouble with clinkering.

Turbo blowers would be required for the air placed, which would amount to about 1,250 cu. ft. per minute.

The water gas at 200° C. would have a volume of

$$\frac{3{,}700{,}000}{3{,}600 \times 24} \times \frac{473}{293} = 69 \text{ cu. ft. per second}$$

so that the gas main would have a diameter of about

$$\sqrt{\frac{69}{60 \times .0786}} = \text{about } 15 \text{ inches}$$

The water gas would be scrubbed with plenty of water in 10-ft. scrubbers, ring filled. It would then pass to a balancing gasometer of about 250,000 cu. ft.

Retort Gas

The advantage of producing the coke from the coal on the site is that the whole of the available by-product of the coal can be obtained and credited to the cost of the ammonium sulphate. The by-products amount to quite 5s. per ton of coal carbonised. Supposing the price of coal to be 20s. per ton, the cost of the primary raw material from which the ammonium sulphate is made is reduced by 25 per cent., *viz.*, to 15s.

The volume of gas obtained from the vertical retorts would be greater than from a coke oven plant and possess a higher cal. value. There is thus more fire available from the coal carbonised, the volume of the gas obtained being

1,600,000 cu. ft. per 24 hours =
1,110 cu. ft. per minute =

$$\frac{1{,}110}{60} \times \frac{363}{293} = 23 \text{ cu. ft. per second at } 90° \text{ C.}$$

The foul main would therefore have to be about 30 inches in diameter, allowing a velocity of flow of about 5 ft. per second. The velocity in the main has to be low, as too great a suction is not permissible on the retorts.

The gas next passes to about four water-cooled condensers (water tube type). Here about 2 cwt. of ammonia sulphate will be dissolved out of the gas per day. Some of the CO_2 and sulphuretted hydrogen and tar will also be removed. The quantity of cooling water required will be about 3,000 gal. per 24 hours.

The gas next passes to the exhauster house. Two turbo exhausters, each to deal with 75,000 cu. ft. per hour, will suffice, one acting as a stand-by.

The gas passes through tar extractors to the purifiers for removal of cyanogen. These boxes would measure about 25 ft. × 25 ft. × 4 ft., and there will be four required.

The gas passes next through a scrubber of the "Whessoe" type to remove the remainder of the ammonia.

The total quantity of ammonia obtained from the condenser and scrubbers will be about half a ton per 24 hours, *i.e.*, about 3,000 gal. of 10-ounce liquor containing 30 per cent. of the total H_2S and some of the CO_2.

As the gas has to be burned under boilers it would probably not be neccessary to extract the H_2S carbon bisulphate and CO_2 from the gas, but if, on the other hand, it would be sold for town supply purposes it would be necessary to allow a space in the benzol and naphthalene scrubbers for the installation of about four iron oxide boxes of similar size to remove the sulphur, amounting to about 1 ton per 24 hours.

The naphthalene would be removed by an oil scrubber, the oil being provided from the tar distillation plant. The quantity of naphthalene obtained would be about 2 cwt. per 24 hours.

The benzol is removed from the naphthalene in an oil-washing plant of the usual type. The oil passes to the stills in the distillation section. About 150 gal. of benzene would be obtained per day.

The gas finally passes through a meter to a gas holder of about 500,000 cu. ft. capacity, sufficient for about an 8-hours' supply. Composition of gas produced:

CO	22%
Hydrogen	50%
Methane	20%
Nitrogen	4%
Hydrocarbons	2%
Cal. value	about 250 C.H.U.

Gas Producers

About 1,750,000 cu. ft. per 24 hours of producer gas would be required to heat the vertical retort system. The composition of the gas would be about:

Hydrogen	26%
CO	15%
CO_2	12%
Nitrogen, etc.	47% (about)
Cal. value	about 72 C.H.U. per cu. ft.

Two 20-ton producers would be employed, one being used as a stand-by. Slack coal would be elevated direct to the bunker above the producers from the store or washing plant. 18 tons of slack coal and breeze from the coke per day would suffice to give the required quantity of gas. The producers (Kerpely type) would be arranged in line with the water gas generators in the same building. Provision to remove ashes and clinker would be required.

The steam required would be obtained from the main boiler system and would amount to about 45 tons per day = 100,000 lb.

The producer gas on its way to the vertical retorts would pass through tar extractors, then it would go through a 12-inch main to a scrubber of the "Whessoe" type to remove ammonia, or the ammonia could be fixed direct in sulphuric acid in the standard type of plant. In the former case about 4,000 gal. of 2 per cent. liquid would be obtained, containing about ½ ton of ammonia. The producer gas would then pass through a meter to a balancing gasometer of about 100,000 cu. ft. capacity, through which it would be drawn by a fan placed in the flue over the vertical retort heating system.

The gas, after being burned in the chambers of the vertical retort system, and after passing the regenerator flues, leaves at about 400° C. The heat from this gas would raise the necessary steam for the steaming of the vertical retorts. It would pass for this purpose through a tubular boiler, proper arrangement being made to ensure that the gas is brought into turbulent contact with the water pipes.

The waste gas is drawn by a suitable fan through the flue or chimney, but it would be arranged that a portion could be by-passed to meet the catalyst water gas main and provide sufficient nitrogen to give a final ratio of nitrogen to hydrogen of 1:3. Thus the flue gas from the producer plant would provide the nitrogen for the ammonia plant at practically no cost. This scheme is obviously more advantageous and economical than one in which air is passed along with the steam into the water gas generators. The additional CO_2 introduced would amount to less than 10 per cent. extra on the total amount of CO_2 to be removed from the hydrogen.

The composition of the flue gas would be about 60 per cent. nitrogen, 12 per cent. CO_2, 28 per cent. H_2O. The volume would be about 4,000,000 cu. ft. per day @ 20° C.

The whole of the flue gases would be made to pass from a water tube boiler through an economiser, where about 100 lb. water could be raised to 80° per minute, while the major portion of the water vapour would be condensed out from the gas, the economiser being allowed to act as a cooler. The volume of the nitrogen required being 860 cu. ft. per 24 hours, that is, about two-thirds of the total volume, is provided from the air during fractional combustion for removal of CO in a later stage of the process. The volume of the vertical flue gas required would only be

$$\frac{287{,}000 \times 100}{60} = 478{,}000 \text{ cu. ft.}$$

or about one-eighth of the total quantity available.

Quantity of By-Products

The total quantity of by-products obtained on the above scheme would be:—

Ammonia Liquor		Ammonia
From retort gas, condensers and scrubbers	3,000 gallons	= 0.5 tons.
From producer gas scrubbers	4,000 ,,	= 0.5 tons.
Total	7,000 gallons of, say, 8 oz. liquor = 1 ton of Ammonia.	
Tar	about 10 tons.	
Cyanogen (as ammonium sulphocyanate)	2 cwts.	
Naphthalene	2 cwts.	
Benzol (from tar oils)	75 tons.	

The ammonia liquor would either be treated in the usual manner for the production of ammonium sulphate or could be used in another portion of the plant for the production of ammonium carbonate.

The tar would be collected together and stored in covered wells for subsequent distillation in a single continuous still. The tar would yield 0.75 ton benzol and 9 tons of dehydrated tar, which in turn would yield about 2½ tons of oil and 6½ tons of pitch. The figure for the benzol includes that from the oil used for the scrubbing of retort gas, which would be treated in the same still.

Napthalene oils would be treated in a small plant where the napthalene would be isolated and casked, unless such plant is already available. It would be much more satisfactory to erect the synthetic ammonia plant at a site where facilities for such treatment of ammonia liquor, tar, naphalene, etc., is already available, so that the first unit would not be weighted with the capital expenditure of the by-product plant, and so that even for the whole plant it would only be a case of additions to the existing plant.

If such a scheme is not possible, part of the economic advantage of the by-product recovery would be absorbed in the buildings, plant, etc., which it would be necessary to erect.

(To be continued.)

FOLLOWING upon research and many experiments, Edgar Allen and Co., Ltd., have evolved a special design of jaw for use in crushers and granulators, which gives longer life and greater capacity than the ordinary standard jaw. Generally, the product is more cubical in form, and there is the advantage that, if required, a machine fitted with "Stag" jaws can be set to give a smaller product than is feasible with ordinary jaws. With the "Stag" design the work of crushing is better distributed, and the stone or rock is allowed to work on itself, giving a better shaped product and eliminating to a great extent the extreme wear which is usual at the discharge point.

Centenary of Chance and Hunt, Ltd.

100 Years of Heavy Chemical Manufacture

ONE hundred years ago this year the foundation was laid at Oldbury of a chemical works which was later to be known throughout the world as Chance and Hunt, Ltd. Chance Bros., the glass makers, lacked room for the expansion of their auxiliary chemical works at Spon Lane, and land was leased by them upon which to erect a saltcake plant employing the now forgotten process of furnacing salt with copperas. A plant was duly erected, and from this small beginning the firm of Chance and Hunt, Ltd., has evolved.

The primary object of the Oldbury works was to provide the necessary saltcake and soda ash for the Smethwick glass works, but by about 1850 such important products as hydrochloric acid, bicarbonate of soda, washing soda, caustic soda, various ammonium salts and, later on, superphosphate were being produced for outside sale. With the appointment in 1868 of Alexander Chance as managing director of the alkali works the firm entered upon a new era of prosperity; of the many improvements on the production side associated with his name it must suffice to mention the process for the successful recovery of sulphur from the Leblanc alkali vat waste, the patent for which was taken out in 1887, and which gave a new lease of life to Leblanc manufacturers who were at that time threatened by the serious competition of Solvay's newly developed ammonia-process.

The year 1890 saw the conversion of the chemical side of Chance Bros. into a private company—the Oldbury Alkali Co., Ltd.—which in 1898 amalgamated with Hunt, of Wednesbury, a chemical firm of importance, founded in 1854. In 1907 works were opened at Stafford for the production of all forms of salt in quantities sufficient to supply the needs of the Oldbury and Wednesbury works and for outside sale. Minor alkali manufacturers in South Wales were absorbed in 1909, and the manufacture of ammonia products centralised at Oldbury, while in 1910 sulphuric acid works at Cwmbran, Monmouthshire, were reorganised by Chance and Hunt, Ltd., and taken over as a subsidiary. A London office for the handling of the export trade was established in 1910, which, in addition to handling the company's own products, has now built up a valuable agency and merchant connection. Similar depots were founded in Birmingham in the following year.

The part played by the company during the war may be judged from the fact that more than 17,000 tons of ammonium nitrate were produced for the Government in the company's works alone. In 1917, Brunner Mond and Co. acquired a controlling interest in Chance and Hunt, Ltd. which now, as a subsidiary company of Imperial Chemical Industries, Ltd., has plants operating at Oldbury, Wednesbury, Stafford and Birmingham, producing such a diversity of products as hydrochloric and sulphuric acids, salt, saltcake, Glauber's salt, ammonium compounds and ammonia liquor, and iron oxide pigments.

Oxidation and Scaling of Metal

Problems that Call for Further Research

THE Metallurgical Research Board of the Department of Scientific and Industrial Research has been engaged for some time in bringing together a comprehensive collection of subjects that call for investigation and are of special importance at this time to the metallurgical industries of this country. Among subjects to which special attention has been given is that of the oxidation and scaling of heated solid metals.

As a prelude to further research, the members of a conference of investigators called together by the Department have prepared a critical survey of existing knowledge of the subject which was published on October 10 (H.M. Stationery Office, 2s. 6d.).

Oxidation and scaling is a phenomenon of great importance in the treatment, fabrication and use of metals. The effective life of metal used under conditions that produce progressive oxidation is bound to be comparatively short and, though the development of heat-resisting alloys has effected a considerable improvement in this respect, there is a great deal to be done. Oxidation during treatment gives rise to a variety of troubles, among them loss of metal, decarburisation, destruction of furnace linings, defects in drop-forgings, unsatisfactory surfaces and so on.

The six sections of the review, each of which is contributed by a well-known authority, deal with the theoretical aspects of oxidation, the constitution and formation of scales on ferrous alloys, the quantitative aspects of the oxidation and scaling of iron and steel at elevated temperatures, the oxidation of non-ferrous metals and the industrial and practical aspects of the subject. The first four sections deal with the mechanism and the rate of oxidation in different temperatures and atmospheres and the nature and properties of oxide layers formed. The last two sections are concerned with the practical aspects of oxidation and scaling and the methods at present available for its control.

The review also calls attention to certain problems upon which further research is necessary and is designed to assist present and future investigators.

National Physical Laboratory

Recent Published Researches

PAPERS read or published by the staff of the National Physical Laboratory during September, included :—

"The inter-relation of age-hardening and creep performance. Part I.—Age-hardening of nickel-silicon-copper alloys, etc." By C. H. M. Jenkins, D.Sc., A.R.S.M., and E. H. Bucknall, M.Sc. Read before the Institute of Metals at Newcastle-on-Tyne, September 11, 1935.

"Alloys of magnesium. Part III.—Constitution of the magnesium-rich alloys containing aluminium and cadmium." By J. L. Haughton, D.Sc., F.Inst.P., and R. J. M. Payne, B.Sc. Read before the Institute of Metals at Newcastle-on-Tyne, September 11, 1935.

"A critical examination of the 'vacuum fusion' method for the determination of the total oxygen in steel." By H. A. Sloman, M.A., B.Sc., A.I.C. Read before the Iron and Steel Institute at Manchester, September 17, 1935.

"Differences in crystal structure of electrodeposited metallic coatings as shown by X-ray diffraction." By W. A. Wood, M.Sc. "Transactions of the Faraday Society," *31*, 1248.

"The setting of dental amalgams. Part IV. By M. L. V. Gayler, D.Sc. "British Dental Journal," *59*, 245.

"Apparatus for raising or lowering the temperature of a laboratory furnace in a pre-determined manner." By F. Adcock, D.Sc. "Journal of Scientific Instruments," *12*, 285.

Commercial Travellers' School

Forthcoming Festival Dinner

THE forthcoming festival dinner in connection with the Royal Commercial Travellers' Schools, Pinner, promises to be especially interesting, because this year marks the completion of 90 years' work. Since the schools were founded in 1845 no fewer than 4,315 boys and girls, the children of deceased and incapacitated commercial travellers, have been educated, maintained and clothed, and fitted for efficient citizenship. At the present time more than 350 children are in residence, and, in providing for education and maintenance, the board of management is faced with the task of raising no less than £25,000 annually from voluntary sources. This year certain additional expenditure, expected to exceed £1,000, must be met—expenditure which had been deferred, for reseating and redecoration of the Elliott Hall and for structural alterations in the main building to provide adequate accommodation for teaching domestic science.

The festival dinner will take place at the Drapers' Hall (by permission of the Worshipful Company of Drapers) on Friday, December 13, when Sir Ernest J. P. Benn, Bt., C.B.E. (chairman of Benn Brothers, Ltd., publishers of THE CHEMICAL AGE), who is this year's president of appeal, will take the chair and will be supported by a distinguished company. In connection with the festival a strong call has been made for financial support to the Schools. Contributions should be addressed to The Secretary, R.C.T. Schools, 17 Cheapside, London, E.C.2.

Association of British Chemical Manufacturers

Increased Membership in a Particularly Heavy Year

MR. E. WALLACE, in the absence through illness of Dr. F. H. Carr, presided at the nineteenth annual meeting of the Association of British Chemical Manufacturers on October 10, and was subsequently elected chairman of the Council in succession to Dr. Carr.

Presenting the annual report, Mr. Wallace read the speech which Dr. Carr had intended to deliver. The past year, said Dr. Carr, had been a particularly heavy one. They had had some very big problems to handle in connection with new trade treaties, the future of the key industry duties and the new poisons list and poisons rules, in addition to routine activities. These three problems alone had required a great deal of concentrated attention and had had to be dealt with at high pressure in view of the comparatively short time allowed to them by the Government to make their representations. That the sterling work that the Association was doing on behalf of the British chemical industry was becoming still more widely appreciated was shown by the fact that eight firms had joined since this time last year, making the total membership 118. There remained a few small firms outside the fold whom they would like to belong to them, but they confidently claimed that the Association, taken in conjunction with its affiliated organisations, already represented substantially the whole of the chemical industry in this country, construed in a wide sense. As membership was entirely voluntary, it proved quite clearly the appreciation of the growing need for co-operation in dealing with the big problems which confronted industry at the present time. They had to record the loss of a number of men who had played an important part in connection with their industry, and he particularly mentioned two who had undertaken important work on behalf of the Association practically since its foundation, namely, Mr. R. M. Bewick and Sir Harold Boulton. Both placed their ripe wisdom and wide experience freely at the disposal of the Council. Their loss had created a gap which it would be hard to fill.

Chemicals at the British Industries Fair

The Chemical Section at the British Industries Fair would be a little larger next year than it was this year. They would like to see it bigger still, so that commercial interests and the public generally might realise the importance of the industry, but they appreciate the special reasons why the exhibition of chemicals at the Fair was not attractive from the point of view of immediate sales promotion. The Chemical Exhibit at the Brussels Exhibition represented an entirely new departure on which they embarked in response to a pressing invitation from the Department of Overseas Trade. Their exhibit was unique and had won commendation in varied and unexpected quarters. It was hoped that as a piece of long range propaganda it would fully justify the time and money spent on it. The Council was appreciative of the way in which the majority of the members gave their willing support to the venture and did everything they could to help in its organisation.

The Association continued to work in the friendliest possible manner with the Import Duties Advisory Committee, and had benefited considerably from favourable recommendations mentioned in the report. Since the report was written the Free List cases on iodine and on essential oils and floral concretes had been brought to a successful issue. A tribute was due to the broadminded and impartial manner in which the committee carried out its onerous task and for the sympathetic hearing that it was always ready to give to the observations of industry, whether in support of or in opposition to the case under consideration.

The Ottawa Agreements which had now been in operation nearly three years would become due for revision in 1937. During the coming year it would be necessary to make a critical survey of their effects in relation to the chemical industry, and, in conjunction with the Federation of British Industries in relation to British industry as a whole, and to determine in what directions modifications were desirable in the interests of the Empire. Accurate and up-to-date statistical data were essential for a critical appraisement of the situation and such data would in due course be compiled in relation to chemical products from the published trade statistics of the various parts of the Empire. The Federation of British Industries was to be congratulated on the valuable survey of Britain's recent commercial policy which it published in June. This survey showed that the results of the Ottawa agreements had been to increase inter-Imperial trade, and that so far the overseas Dominions had reaped greater benefits than the United Kingdom. British exports to Empire countries had increased from £170,700,000 in 1931 to £185,600,000 in 1934, and imports from these countries from £247,400,000 to £271,400,000.

The survey also gave useful indications as to the result of the trade treaties which the Government had negotiated with foreign countries since the Ottawa Conference. Many of the treaties were still of too recent origin to allow of their full effects being developed. The survey of the Federation of British Industries indicated that the trade agreement countries were the most satisfactory of their foreign customers, but the figures did not show the same reassuring increase in exports as did the trade statistics for the Empire.

The New Trade Treaties

There was one point to which Dr. Carr wished to draw the particular attention of members in connection with new trade treaties. The Government was being guided more and more by representative associations in their negotiations, and actually left the chemical section of the Polish treaty to be hammered out between the Association and the Polish Union of Chemical Industries, an arrangement which worked remarkably well. They wished to encourage this and realised that it rested with them to show that their industry could be entrusted to carry out such negotiations in the common interest. If they were to succeed, they must make an intensive study of the chemical markets in the country with which negotiations were in progress, so that they might know precisely which concessions would be of real benefit to their industry—bearing in mind that these treaties were all on a most favoured nation basis—and they needed to be in a position to give an estimate of the extra trade that was likely to accrue from the concessions they demanded. This latter point was essential; treaties were to a large extent made on a *quid pro quo* basis and the Government must be given every assistance in weighing up the comparative values of the advantages which it gave and those which it received. When the treaty had been concluded, there was an obligation on them individually and collectively to follow up and utilise for the national good the concessions which had been secured. Poland was an instance of the action which the Association had taken, and was willing to take, to assist members in securing information regarding the new opportunities created by the trade treaties. With the full knowledge of the possibilities of the market before them, members were thus able to decide as to the steps they must take to secure the business.

The Association's safety activities were well known and widely appreciated and thanks were due to the Works Technical Committee for its continuous labours in the cause of safety. That they had the confidence of the Home Office was revealed by the willingness with which that Department agreed to co-operate in the revision of the recommendations arising from the Mitcham explosion, to bring them into line with the practical requirements of industry, and so make them more effective instruments of safety. The provisional and draft poisons list and poisons rules had meant a tremendous amount of work which had to be done in a very limited time. It was indeed an achievement that on both drafts they were able to present unanimous recommendations representing the views of the Association and all its affiliated organisations. The substantial amendments which were secured in the provisional list and rules were a clear indication of the weight of the Association's arguments and it was hoped that their further representations on the official draft would be equally successful.

The subject of industrial reorganisation was one which was at the present time actively in the minds of all leaders of industry. In pre-war days, the eminence of this country

in the realms of industry and commerce was the product of vigorous individualism. This prompted keen competition and up to a point stimulated efficiency and encouraged progress. At the same time, it was the cause of some stagnation as the result of wasteful overlapping and duplication of effort notwithstanding the corrective of what had been called "healthy bankruptcy" to weed out the less efficient. In the post-war years individualism had by gradual steps been called upon to adjust itself in accordance with the requirements of the new spirit of economic nationalism which had arisen. Competition in the home and international markets became intensified when the post-war slumps came and in some industries the results were well-nigh disastrous. Bankruptcy of the weaker members of an industry did not provide the same corrective as it used to do, and some of the biggest interests were threatened and even bled white as a result of the ruthless price cutting that ensued in the struggle for the limited amount of business available. Thus British industry, through such causes fanned by high taxation, due in large measure to the unemployment problem, was compelled to resort to reorganisation in order to render it still capable of competing effectively in the foreign markets. Hence the origin of the much misunderstood theory of rationalisation, which in its original conception meant nothing less than the scientific reorganisation of industry

Industrial Organisation

The new idea of industrial reorganisation, of which Lord Melchett's recent Bill was an important example, visualised the planning of industry as a co-ordinated whole by industry itself or, in other words, the self government of industry subject to the common interest. The Bill contemplated the compulsion, by statutory order, of recalcitrant minorities who would refuse to accept any voluntary scheme of organisation or planning and who might by their refusal render inoperative the efforts of the majority to put the industry on a more economic basis. The advocates of such measures held up the bogey of nationalisation as the ultimate and inevitable alternative to their plans for industrial self government. British industry as a whole realised that the time had come when the old individualism must be restrained and must make way for a gradually increasing measure of co-operation, but the problem was how to retain the undoubted value of individualism and its stimulating effects on progress and at the same time secure a more rational planning of industry. In other words, the aim was to devise a scheme by which industry could develop in accordance with a definite plan which would eliminate redundant plant and wasteful competition, while retaining in the detailed working out of the plan that freedom of action for the members of the industry which had proved such an incentive to progress in the past. Perhaps the greatest weakness of all such schemes was that the opposing minority might be, and, indeed, often was, the most progressive section of the industry, and to tie it down would not be to the ultimate good of the industry or of the country.

Freedom for Individual Effort

The committee of the Federation of British Industries which investigated the various schemes of reorganisation came to the conclusion that the results desired could best be obtained through an extension of voluntary associations such as the A.B.C.M. With this view they were in complete agreement. The chemical industry was one which afforded practically unlimited scope for new developments by the scientific application of chemistry, physics and engineering, and if that development was not to be impeded it was necessary to preserve the best features of individualism and to give the individual members of the industry adequate scope for their efforts while preserving a generous measure of unselfish technical co-operation. To secure this freedom for individual effort, without creating the evils of undue duplication and wasteful competition, it would appear necessary to accept some control of the areas in which their energies were to be developed by means of voluntary schemes of co-operation, and as part of that policy to give help and encouragement to the small firm to develop along the lines for which it was best equipped. It was by foregoing certain aspects of so-called freedom of action that they might achieve the greatest scope and power for individual effort. The last few years had seen a steady growth in the Association of the co-operative spirit in dealing with problems of common interest. What they required now was an extension of this co-operation in connection with research, production and marketing activities. There was plenty of room for all to work together in a comprehensive plan. Not only could this be done, without imposing any irksome restrictions on the individual unit, but by allotting to each firm the lines along which it could best develop, there would be an added stimulus to progressive development in a manner which would benefit the industry as a whole.

Since the report was written, a supplementary memorandum has been submitted to the Key Industries Committee of the Board of Trade setting forth the detailed reasons why the fine chemical makers considered that the progressive development of the industry would be better assured by a continuance of the key industry duties rather than by a transfer to the Import Duties Act. The key industry duties were based on national security and afforded stability, continuity and freedom from interference. The Import Duties Act, which was passed with entirely different objects, did not, in its present form, possess these basic characteristics which were essential for the progressive development of industries on which the future safety of the nation might well depend.

In conclusion, Mr. Wallace said that Dr. Carr had asked him to express his sincere appreciation of the support which he had received at all times from all members of the Association during his two years of office, and especially from his colleagues on the Council. To all of them and to all of the committees of the Association he desired to tender his best thanks for the willing help which they had given him in dealing with the many difficult problems which had been before the Association and the Council during his period of office. He asked him to give emphatic expression of praise and gratitude to the general manager for the magnificent manner and tireless energy with which he discharged his duties. A special word of commendation must also be given to his staff for their untirng efforts on behalf of the Association during a particularly heavy year.

The following elections were made at the meeting :—President—Dr. E. F. Armstrong; vice-presidents—Dr. C. Carpenter, Dr. F. H. Carr, Sir Christopher Clayton, Mr. C. A. Hill, Sir David Milne-Watson, Mr. R. G. Perry; honorary vice-presidents—Sir Martin O. Forster, Mr. D. Lloyd Howard, Sir Harry McGowan, Sir Robert Mond. The following eight Members of Council, who retired in rotation, were re-elected : Mr. G. E. Howard, Mr. L. P. O'Brien, Mr. D. J. W. Orr, Mr. A. E. Peak, Captain D. S. Peploe, Mr. F. M. Roberts, Mr. E. Wallace and Mr. K. H. Wilson.

The annual dinner was held at the Dorchester Hotel, Park Lane, on October 10, under the chairmanship of Mr. E. Wallace, and was attended by a company of close upon 300. Amongst the principal guests were Sir William Bragg, Lord May, Sir Robert Robertson, Sir Edward Crowe, Sir Henry Sutcliffe Smith, Sir Christopher Clayton, Sir David Milne-Watson, Sir Allan Powell, Mr. W. A. S. Calder, Dr. Herbert Levinstein, Professor G. T. Morgan, Sir Percy Ashley and Professor E. C. C. Baly. The toast of the guests was proposed by Mr. N. N. Holden and responded to by Sir William Bragg and Sir Henry Sutcliffe Smith. Mr. W. J. U. Woolcock proposed the toast of the Government Departments, and Sir Robert Robertson responded. Mr. W. A. S. Calder, Mr. E. V. Evans and the Chairman were other speakers.

Utilisation of Waste Products

First British Manufacture of Sodium Chlorate

ONE of the secrets of success in business is to make full use of waste products or surplus energy. The Staveley Coal and Iron Co., Ltd., who are very large producers of electrical energy from the waste gases produced at their blast furnaces etc., have already made some good use of this electrical energy in the manufacture of caustic soda, liquid chlorine, bleaching powder, and synthetic hydrochloric acid. Having still a surplus of power, the company has decided to make use of this in the interests of the chemical trade of this country by installing a plant for the electrolytic manufacture of sodium chlorate which is an article not being made in this country at the present time. The plant it is installing will not be completed for several months, but when ready will be capable of producing more than is at present consumed in the British Isles. Possessing through its subsidiary, the British Soda Co., Ltd., a plentiful supply of salt, the company has great confidence in this new venture.

Modern Methods of Welding

Instructive Paper Read to the Institution of Chemical Engineers

IN a paper on "Modern Methods of Welding," read at a meeting of the Institution of Chemical Engineers on Wednesday, October 9, C. H. Davy said that the procedure of joining two pieces of metal by the process of welding must be almost as old as the industry of metal-working itself. Sir Robert Hadfield. in his book entitled "Metallurgy and its influence on Modern Progress," refers to an iron pillar at Delhi which is believed to have been made about A.D. 300 and which can only have been fabricated in sections welded together.

Looking broadly at the fabrication of pressure vessels, containers, and plant used in heat exchange, welding can be classified under the headings:—

Forge and hammer welding.
Acetylene welding.
Electric resistance butt welding.
Atomic hydrogen process.
Metallic arc fusion welding.

Advantageous Use of Atomic Hydrogen

Acetylene welding has often been employed successfully in the construction of vessels employing light plates, and was frequently used at one time in securing flanges in welded pipe lines. Properly controlled, it offers considerable possibilities, and it is always a matter of some surprise that automatic machines for acetylene welding have not been developed to any marked degree. Had the metallic arc fusion welding process offered fewer advantages, much greater development work would have taken place in acetylene welding. In France the possibilities connected with acetylene welding machines which are automatically controlled have been appreciated, and already a considerable amount of successful work has been done. Speciments, welded by automatic machines, have given good results under test, and the low cost of this method of welding makes it worthy of serious consideration where steel plates of a thickness of the order of $\frac{1}{2}$ to $\frac{3}{4}$ in. have to be joined together by butt welding.

The use of atomic hydrogen is one of the later developments in the field of welding and appears to have certain advantages. Although an electric arc is used, its application is indirect, and up to the present covered electrodes have not been utilised to any extent. An arc is maintained by an alternating current between two tungsten wire electrodes and a stream of hydrogen gas is introduced around the arc. The temperature of the electric arc is sufficiently high to cause dissociation of the hydrogen molecules, and the atomic hydrogen on leaving the zone of the arc at once recombines to form again hydrogen in the molecular state. The latter process is a reversal of the heat input from the electric arc and energy is given up, and provides the heat required for welding.

At the present stage, welding by atomic hydrogen has not proved very suitable for plates above $\frac{1}{2}$ in. in thickness, but for welding thin stainless steel sheets it offers considerable advantages.

The mechanical properties of atomic hydrogen welds in plain carbon steel are similar to those which are obtainable with a good metallic arc using first-class covered electrodes and maintaining a short arc.

Undesirable Effects of Nitrogen

The good mechanical properties of an atomic hydrogen weld may be seriously affected if the source of hydrogen supply is unsatisfactory. Hydrogen produced by electrolysis of ammonia, if used for this purpose, is liable to produce welds containing an undesirable percentage of nitrogen, which will have an adverse effect on the resistance to age-hardening and fatigue. The atomic hydrogen process can be applied with good results in certain cases where metallic arc welding is not easily utilised, such as in the welding of thin aluminium or duralumin sheets if used in conjunction with a flux. Nickel and a number of non-ferrous nickel alloys can be readily welded, whilst nickel chromium alloys with high nickel contents may be satisfactorily worked.

Metal deposited in the weld from bare electrodes contains a number of major defects, such as incomplete fusion with parent metal, slag inclusions and porosity.

Apart from the presence of such defects, the use of the bare electrode results in considerable atmospheric contamination of the weld metal, this contamination being exaggerated by the instability of the arc when using electrodes of this type. The atmospheric contamination causes oxide and nitride inclusions in the weld metal which tend to make the metal brittle, even if present only in minute quantities.

Examination of the weld metal under the microscope reveals the presence of these inclusions, noticeably needle-shaped nitrides.

Microstructure of Weld Metal

The weld metal must have physical and chemical properties similar to those of the parent metal, and to tulfil this requirements the microstructure of the weld metal must be of a certain predetermined type, whilst means must be provided to replace in the weld metal the carbon, silicon and manganese list due to volatilisation of these elements in the arc. Coated electrodes therefore have to be used, and machines have to be developed capable of feeding coated electrodes without stopping and starting at short intervals for electrode replacement, The success of any welding operation depends fundamentally upon two factors: the electrode and the technique of its use. The importance of the electrode, therefore, justifies a more detailed description of the manufacturing methods than is normally revealed.

The electrode consists of two portions, the steel wire and the coating attached thereto. An ordinary chemical specification does not completely define the requisite quality of steel necessary for a suitable electrode. Further, the quality of steel wire which works admirably with one type of electrode coating may be totally unsuitable when used in conjunction with a different type of coating. In defining the quality or type of steel, it is therefore necessary to bear in mind the electrode coating which it is intended to employ. Practical experience permits an empirical approach to this subject, and research is in progress towards a full elucidation of the basic facts by which it is regulated. At present the quality of the wire has to be investigated experimentally in collaboration with the manufacturers, to learn by actual welding tests which method of steel manufacture produces the quality of wire desired. Only by such methods is the steel manufacturer able to meet consistently an electrode wire specification which states that the wire on test has to prove perfectly satisfactory for the purpose intended.

Variable Factors in Welding

The deposition of weld metal by means of the metallic arc involves a close study of three main variables:

(*a*) the electrical input to the arc;
(*b*) the speed at which the electrode travels along the seam being welded; and
(*c*) the shape of the groove formed by the abutting plates.

The quality of weld metal deposited from an electrode depends largely on the amperage and voltage of the arc.

The second variable is also self-evident, but it is a matter which is frequently inadequately investigated, so that poor weld metal can result in apparently mystifying circumstances. With given electrical conditions and an excessive speed of travel of the electrode along the seam, the heat generated in the vicinity of the arc will not be sufficient to fuse the sides of the groove being welded, and at the junction between the weld metal and the plate there will remain a thin film of non-metallic material, for instance slag, which will constitute a definite weakness at the joint. Time is naturally an important factor in raising the temperature of the parent metal to the degree necessary.

If the speed of the electrode is too low, three conditions can follow. First, the run of weld metal deposited is of too great a thickness so that subsequent recrystallisation by the succeeding run is confined to a relatively small depth of the metal. Secondly, the heat generated in the vicinity of the arc causes excessive fusion of the plate and pockets enclosing slag are formed. Thirdly, the slag arising from the electrode coating, instead of being controlled to freeze behind the arc, will flow in front of the electrode and become overlapped by the weld metal.

Having once, therefore, determined the electrical input to the arc for good quality weld metal, the speed of travel of the electrode must be considered in relation to the shape of the groove in the plate. A groove, having a U-shaped section, is almost universal for heavy plate because the change in the width of the groove after each layer of weld metal has been deposited is amost negligible and because the almost vertical line of fusion is admirably suited to X-ray inspection. The minimum dimensions of the groove are controlled by the electrode used. The narrower the groove, the less the amount of weld metal necessary and the cheaper the fabrication. The factor of primary importance which determines the minimum width of groove is the first layer of weld metal deposited. If the groove is too pointed at the root of the weld, inadequate penetration at the base of the groove will follow. It is true that chipping out the underside of the weld to a sufficient depth will remove a zone of this description, and re-welding can then be done from the underside, but in commercial welding it is clearly necessary to reduce such chipping to the minimum on account of cost.

Before leaving the metallurgical side of this problem some attention has to be paid to the disturbed area in the parent metal immediately on each side of the weld. There are many practical difficulties which prevent the normalising of the finished drum. It is not possible to heat the finished drum to a temperature of the order of 900° C. to recrystallise the material. In addition, considering the weld metal, this recrystallisation would be undesirable because the rate at which the whole mass of the drum could be cooled through the upper 400° C. of the temperature curve would be such that a grain structure of very much coarser type would result in the heat-treated weld itself, and, the laminar structure of the plate would lose the fibrous nature which makes it particularly suited to carry circumferential stresses, such as the hoop stress, etc., to which the drum is subjected in service. The only theoretical reason upon which recrystallisation in such a vessel can be advocated is to remove the disturbed area in the parent metal immediately adjacent to the point at which fusion between the weld metal and parent metal takes place. Practical investigation of this question, however, considerably reduces any argument in favour of recrystallisation.

Points from the Discussion

The CHAIRMAN said it appeared to him that we had travelled very far indeed since the use of thermite, which was at one time universally employed for welding large sections, and particularly for tramway rails, and a tremendous advance had been made within a comparatively few years. Nevertheless, he gathered that there were still a great many things which had to be investigated. For instance, the author had spoken of heat treatment and normalising, but personally he would have thought that that very difficult question might have been settled by the results of practical experience.

The explanation of the atomic hydrogen process given in the paper put this matter very much more clearly than he had ever heard it before, assuming the author's hypothesis was correct. He had been very much struck with the process when he had first seen it at an Olympia Exhibition a few years ago, and he had written to the protagonists of that process for an explanation and received one which he could not understand one little bit. On the other hand, the author had explained it in an exceedingly simple manner in the following words: "The temperature of the electric arc is sufficiently high to cause dissociation of the hydrogen molecules, and the atomic hydrogen on leaving the zone of the arc at once recombines to form again hydrogen in the molecular state. The latter process is a reversal of the heat input from the electric arc and energy is given up, and provides the heat required for welding." That explanation was an entirely satisfactory one, but his difficulty was whether this really took place and had it been proved. Presumably every one of the processes outlined in the paper had its own particular points. He could quite well understand that in the case of internal pressure vessels, probably the electric resistance butt welding process might be better than the acetylene process or the atomic hydrogen process, although probably the author held the view that the best all-round process was the metallic arc fusion process.

Mr. J. H. G. MONYPENNY, referring first to the heat treatment of welds, asked the author to give some information, rather more definitely than had hitherto been published, regarding the actual amount of internal stress which might be left in a single longitudinal weld or in a case where a longitudinal weld was crossed by a circumferential weld. The author had made a passing comment about the application of the atomic hydrogen process to stainless steel. He could appreciate that that method of welding had very decided advantages from the point of view of ordinary carbon steels, inasmuch as the weld metal was likely to have a much lower carbon content owing to the reducing action of the hydrogen on the carbon. From the point of view of stainless steels also, that process had very definite advantages over the arc process, in certain cases where that process was not so easily adaptable. Speaking entirely from the metallurgical effects of welding, the atomic hydrogen process had a definite advantage because there was no carburisation of the weld which was extremely difficult to avoid with other processes, even by the arc process, and with the atomic hydrogen process there should be no oxidation of the weld metal.

Carburisation Troubles

The author's remark about carburisation perhaps needed a little amplification. With oxy-acetylene welding, carburisation perhaps needed a little amplification. With oxy-acetylene welding, carburisation very easily occurred owing to the very great avidity with which any chromium steel would absorb carbon. It was claimed that there was not that same absorption with the electric arc process because carbon was not there, but many electrodes seemed to contain a certain amount of carbonaceous matter and then there was a tendency for a slight increase of carbon generally, and with materials in which the carbon content must be a maximum of, say, 0.12 per cent., the absorption of even 0.04 or 0.05 per cent. was an important matter.

Dr. S. F. DOREY (Lloyds Register), speaking with regard to the atomic hydrogen process, asked the author if there was any positive evidence of gaseous nitrogen contained in the welds and whether the hydrogen produced the electrolysis of ammonia. It was generally said that the nitrogen evolved from the ammonia remained inert and did not affect the weld. One would imagine from what the author had said as to bare wire welding that bare electrodes were not all that could be desired, but it should be emphasised that that only referred to high-class work such as pressure vessels. There was no doubt, however, that it was possible to get good sound welds with bare electrodes, but the thing that was not obtained was a ductile weld.

Electrode Manufacture

Electrode manufacture was largely a matter for the chemist and the metallurgist working together. The making of electrodes was primarily a question of steel making. It had been said that it was unnecessary to use what might be called a killed steel for electrodes due to the fact that in the process of depositing, the steel would be killed and therefore it did not matter much what it was like; if the semi-killed steel was used, there would probably be effervescence which would not be all that might be desired for depositing. Heat treatment was a very difficult matter to discuss. Were we coming to the point where heat treatment was really necessary? This might seem a bold statement to make but if one could produce a weld such as the firm of Babcock and Wilcox did, claiming that they could refine the structure and also the layers one on the other by an annealing effect, it was difficult to know what residual stresses were left and had to be removed. Nevertheless, there must be some process of removing the residual stresses which were imagined to exist and he was interested to know whether the author had carried out any experiments on stress relieving by mechanical means. Could the author say whether he had carried out any such experiments? He (Dr. Dorey) believed that experiments of ths nature had been carried out by firms not in this country.

Finally, Dr. Dorey referred to distortion and said it seemed to him that if the apparatus to be welded was so strutted as to prevent distortion, it was quite possible that the stresses might be localised to such an extent that failure would occur. It could be imagined quite well that if a simple circular body was strutted in that manner it would buckle somewhere and relieve itself at a place where it would not have so much effect that it would in another place. It was, therefore, a question which required careful consideration although too much rigidity would certainly localise the stresses

Mr. C. C. HALL (Firth-Brown) said he had been wondering

whether any experiments had been carried out with X-rays before stress relieving by normalising or low temperature treatments, and whether the X-ray photographs revealed any stress lines showing where stresses occurred. Had anything been done in the case of pressure drums, for example? On the question of adequately supporting vessels during welding to prevent distortion, his experience had been that it was possible to go too far in that direction. Obviously if a vessel which was being welded was held in such a way that it could not move, there was no doubt that the stresses were more localised and usually on the line of the weld. In the case of these large vessels, he believed that was the main reason why stress relieving treatment should be applied.

A Greater Degree of Distortion

Mr. W. B. SHANNON (London Power Co.) said his experience of oxy-acetylene welding and metallic arc welding was that the former was inclined to give a less porous result. The trouble with oxy-acetylene welding, however, was the existence of a larger area under heat, when the weld was being carried out, which tended to a greater degree of distortion. He had had experience of joints made by oxy-acetylene and metallic arc welding, and, on the whole, there was not a great deal to choose between the two methods. On the other hand, there was less skill required with the oxy-acetylene process and therefore slightly more lattitude was allowed to the operator. In connection with flash welding he would say, without the slightest hesitation, that Babcock and Wilcox could produce a flash weld which was second to none. That not only applied to the joining of mild steel to mild steel, but also to the joining of one complex alloy to another.

Mr. W. E. DOUGLAS (Engineering Department, Asiatic Petroleum Co.) asked whether the firms in this country who were making pressure vessels by the electric arc process did or did not habitually arrange for stress relieving. He believed that in America and in Germany, and particularly at Krupp's works, they would not be prepared to turn out a drum of that nature with walls running up to 4 inches in thickness without careful treatment afterwards. Was it to be understood that the firm of Babcock and Wilcox were not prepared to do that sort of thing? It had been mentioned during the discussion that for certain purposes oxy-acetylene welding was just as good as metallic arc welding, but his view was that anyone who had tried to put on a thin patch on a large expanse of metal by the oxy-acetylene process and had then tried to do the same thing by the electrode arc process would have no doubt about which was to be preferred. Although oxy-acetylene welding had a very definite place there were many purposes for which it was quite inferior to electric arc welding. He (Mr. Douglas) rather gathered the author had much the same idea.

Soundness of the Weld

Dr. H. HARRIS said that as a colleague of the author perhaps he could relieve him of the burden of answering some of the questions which had been put to him. The Chairman had asked whether the dissociation of hydrogen in the atomic hydrogen process had been proved. If reference was made to the original work of Langmuir on that subject it would be found that the author's statement was well established. The question of carburisation of stainless steel in metallic arc work had been mentioned by Mr. Moneypenny, who rather anticipated that the carbon content of the weld metal would increase somewhat above the maximum allowed in many stainless steels of about 0.12 per cent. Using a stainless steel electrode and a proper covering the only carbon would be that from the steel so that this was a question which came back to the steel manufacturer. If a proper covering was used no difficulty would be encountered.

He disagreed with many of the statements which Dr. Dorey had made. Dr. Dorey made one rather surprising statement that the soundness of a bare wire weld was equal to that of a weld made with a properly covered electrode. Personally, however, he would like to know how it was done, because he had never seen a bare wire weld which in any way approached the soundness of a properly laid weld metal from a covered electrode of first-class quality. As to the type of steel used in electrodes, the general experience was that the semi-killed steel was better than killed steel although he did not know why. The metal seemed to flow much more evenly and maintained the arc in a more stable condition than was the case with killed steel electrode. Dr. Dorey had also raised the question of whether stress relief by mechanical means had been considered. Although that had not been dealt with in the paper to any great extent, in the actual fabrication of vessels by welding, mechanical work was done on the weld metal by peening and it was done definitely to reduce the localised stresses. In that way it was possible to reduce or average out any localised stresses which might occur in the finished drum. At the same time, he rather thought Dr. Dorey was thinking of relieving the final drum by mechanical means, but so far as he was aware not much work had been done on that and he should not imagine that it would be a particularly proper method of going about it.

The major point upon which he disagreed with Dr. Dorey was on the question of distortion. The forces set up causing distortion in a vessel were very considerable and he maintained it was necessary to make the job sufficiently rigid to stop any bending around the weld and minimise the cracking trouble. If the plates were allowed to move and have a tendency to bend during welding, the welding problem became far more serious that if the job was supported rigidly.

Dr. DOREY asked for a little further explanation from Mr. Douglas concerning his remark relating to the policy of Krupps with regard to heat treatment. He gathered that, according to Mr. Douglas, Krupps heat-treated their drums.

Mr. DOUGLAS replied that he was not necessarily referring to boiler drums but to large pressure vessels subject to high pressures and high temperatures, and he knew for a fact that in the case of such things as reaction chambers Krupps regarded heat-treatment as a very critical process, and a very necessary one. Therefore, he would be only too pleased if there were firms in England who had developed the process of welding in such a manner as to avoid this very critical after-heat-treatment. He certainly understood that Krupps, a few years ago, were giving very delicate heat-treatment to such welded drums.

Low Temperature Relief Stress

Dr. DOREY remarked that the point which worried him in connection with what Mr. Douglas had said was that at the present time Krupps persisted in doing without heat-treatment.

The AUTHOR, replying to those points raised in the discussion which had not been dealt with by Dr. Harris, said that low temperature stress relief is regarded as a necessity by Babcock and Wilcox. Indeed, he would go farther and say that the firm would not be prepared to put out a vessel without subjecting it to low temperature heat-treatment. Generally speaking, the practice in France appeared to be about half and half, some manufacturers preferring low temperature heat-treatment at 600° C., whilst others preferred 900° C. In America the balance of opinion was in favour of low temperature stress relief, and although as regards Germany Dr. Dorey seemed to be primed with knowledge, his own information was that again about half the manufacturers were in favour of low temperature heat-treatment and half in favour of high temperature. He had been interested to hear the views expressed about Krupps, because the last job he had anything to do with for them was a steel drum which they were in favour of normalising. Frankly, he did not see much possibility of going very far with thin welded vessels if they had to be normalised because of the distortion.

The question of fine cracks had been mentioned by Dr. Dorey and he was in full agreement that X-rays would not show up fine cracks, but the point made in the paper was the necessity for starting out, in the first place, to design weld grooves so that the groove was shaped to produce any cracks which might occur in a certain definite plane or within certain definite planes. X-rays would show up a hair crack or a very fine fracture if the crack ran parallel to the direction of the rays, but it would not show up a very fine crack if it ran transversely to the direction of the rays.

SILVER production in Mexico during the first half of the current year totalled 42,244,000 ounces, as against 37,510,000 for the first six months of 1934. The mining industry is still faced with serious labour difficulties. Six hundred miners at Matehuala have not returned to work and over 1,500 workmen at the Chihuhua lead smelter—reputed to be the largest lead smelter in the world—walked out on August 10. A strike was averted at the Angangueo silver mines in the State of Michoacan when the operators agreed to increase wages.

British Overseas Chemical Trade in September

Slight Increase in Exports

ACCORDING to the Board of Trade returns for the month ended September 30, exports of chemicals, drugs, dyes and colours were valued at £1,592,791, as compared with £1,572,547 for September 1934, an increase of £20,244. Imports were valued at £1,049,689, as compared with £986,196. Re-exports were valued at £45,471.

	Quantities. September 30. 1934.	Quantities. September 30. 1935.	Value. September 30. 1934. £	Value. September 30. 1935. £
Imports				
Acids—				
Acetic .. .. cwt.	14,970	7,085	24,471	10,637
Boric (boracic) .. ,,	4,910	2,940	4,626	3,085
Citric .. .. ,,	341	1,023	917	4,098
Tartaric .. ,,	1,345	1,829	5,831	7,746
All other sorts .. value	—	—	7,159	6,560
Borax .. .. cwt.	21,897	10,420	10,985	5,396
Calcium carbide .. ,,	83,677	71,046	53,550	39,744
Phosphorus .. ,,	2,166	2,132	6,986	7,307
Potassium compounds—				
Caustic and lyes cwt.	9,174	9,321	11,163	10,809
Chloride (muriate) ,,	230,958	281,862	67,936	90,723
Kainite and other mineral potassium fertiliser salts .. cwt.	361,976	294,948	61,053	55,278
Nitrate (saltpetre) ,,	29,099	46,704	12,047	17,078
Sulphate .. ,,	278,869	209,378	97,342	86,021
All other compounds ,,	8,900	8,500	15,425	11,897
Sodium compounds—				
Carbonate, including crystals, ash and bicarbonate .. cwt.	262	—	189	4
Chromate and bichromate .. .. cwt.	2,468	12,647	3,528	17,050
Cyanide .. ,,	800	2,701	1,831	6,466
Nitrate .. .. ,,	30,295	43,893	6,220	8,825
All other compounds ,,	15,291	17,486	11,192	13,876
Other chemical manufactures .. .. value	—	—	193,704	220,268
Drugs, medicines, etc.—				
Quinine and quinine salts oz.	114,728	96,196	9,661	8,934
Medicinal oils .. cwt.	1,470	3,142	7,531	17,666
Ointments and liniments cwt.	2	96	183	3,992
Proprietary medicines value	—	—	63,104	51,223
All other sorts, manufactured or prepared value	—	—	21,441	43,146
Bark Cinchona (bark Peruvian, etc.) cwt.	167	667	1,000	2,290
All other sorts, raw or simple prepared value	—	—	40,552	33,940
Dyes and dyestuffs and extracts for tanning—				
Finished dyestuffs (coal tar) .. .. cwt.	2,816	2,492	75,587	73,749
Extracts for dyeing ,,	2,904	3,913	6,350	8,174
Chestnut extract ,,	14,658	34,542	10,325	22,914
Quebracho extract ,,	30,231	16,431	17,743	11,799
All other extracts for tanning .. cwt.	20,903	42,732	14,220	29,878
All other dyes and dyestuffs .. .. cwt.	634	744	9,016	14,612
Painters' colours and materials—				
White lead (basic carbonate) .. .. cwt.	6,855	7,082	8,089	8,540
Lithopone .. ,,	15,370	17,006	10,090	11,357
Ochres and earth colours cwt.	22,298	28,314	8,127	10,252
Bronze powders ,,	1,117	1,758	7,956	12,184
Carbon blacks .. ,,	27,175	21,980	41,982	32,716
Other pigments and extenders .. cwt.	23,333	29,437	7,370	9,587
All other descriptions ,,	15,674	11,806	29,714	19,877
Total .. .. value	—	—	986,196	1,049,689
Exports				
Acids—				
Citric .. .. cwt.	3,143	2,275	10,731	9,982
All other sorts .. value	—	—	19,166	21,339
Aluminium compounds tons	1,005	1,753	5,304	19,668
Ammonium compounds—				
Sulphate .. tons	19,591	16,244	114,998	95,234
All other sorts .. ,,	958	864	14,504	11,098
Bleaching powder (chloride of lime) .. .. cwt.	42,903	53,512	12,418	14,458
Coal tar products—				
Cresylic acid .. gal.	143,791	125,870	12,771	10,744
Tar oil, creosote oil, anthracene oil, etc. gal.	3,105,003	3,496,597	59,568	83,268
All other sorts .. value	—	—	13,637	23,609
Copper, sulphate of tons	331	566	4,254	8,117
Disinfectants, insecticides, etc. .. .. cwt.	36,340	35,243	73,609	76,991
Glycerine .. .. ,,	12,234	11,336	28,710	27,848
Lead compounds .. ,,	13,539	13,269	17,252	16,737
Magnesium compounds tons	433	411	10,300	9,754
Potassium compounds cwt.	6,385	4,127	15,445	11,843
Salt (sodium chloride) tons	22,089	22,232	56,457	57,683
Sodium compounds—				
Carbonate, including crystals, ash and bicarbonate .. cwt.	327,427	315,164	83,059	76,097
Caustic .. .. ,,	172,203	188,081	94,110	94,408
Nitrate .. .. ,,	8,823	24,157	3,275	8,491
Sulphate, including saltcake .. .. cwt.	34,625	61,210	3,755	5,242
All other sorts .. ,,	60,781	67,912	86,408	86,783
Zinc oxide .. .. tons	986	1,224	18,810	21,908
All other descriptions value	—	—	214,460	213,908
Drugs, medicines, etc.—				
Quinine and quinine salts oz.	125,097	75,500	14,079	9,689
Proprietary medicines value	—	—	112,444	92,755
All other descriptions ,,	—	—	121,446	141,514
Dyes and dyestuffs and extracts for tanning—				
Alizarine, alizarine red and indigo (synthetic) cwt.	1,446	1,604	9,617	8,255
Other finished dyestuffs (coal tar) .. cwt.	5,994	5,839	84,709	74,743
All other descriptions cwt.	28,428	12,518	32,281	20,952
Painters' colours and materials—				
Ochres and earth colours cwt.	15,365	15,669	13,970	15,025
Other pigments and extenders, dry .. cwt.	20,054	23,098	23,971	29,698
White lead .. ,,	6,745	5,700	12,200	11,571
Paints and painters' enamels, prepared cwt.	34,598	33,327	88,260	88,382
Varnish and lacquer gal.	61,958	70,214	24,619	25,927
All other descriptions cwt.	27,713	35,186	61,950	69,070
Total .. .. value	—	—	1,572,547	1,592,791
Re-Exports				
Chemical manufactures and products .. value	—	—	10,964	19,580
Drugs, medicines, etc.—				
Manufactured or prepared .. .. value	—	—	11,751	10,006
Raw or simply prepared value	—	—	13,369	12,634
Dyes and dyestuffs and extracts for tanning cwt.	700	592	1,145	1,367
Painters' colours and materials .. .. cwt.	261	666	691	1,884
Total .. .. value	—	—	37,920	45,471

Notes and Reports from the Societies

Society of Chemical Industry

Road and Building Materials Group

THE first meeting of the new session for the Roads and Building Materials Group will be held on Wednesday, October 23, in the rooms of the Chemical Society, Burlington House, Piccadilly, W.1, when a paper entitled "Investigations on the Slipperiness of Roads," will be presented for discussion by Dr. R. N. J. Saal, of the Amsterdam Laboratory, Bataafsche Petroleum Maatschappij (Shell Group). In view of the great importance at the present time of the subject of skidding and of the development of laboratory apparatus whereby the non-skid characteristics of different types of road surfaces may be studied, Dr. Saal's paper is of exceptional interest. It is hoped that as many members as possible will attend and will bring with them any other persons who would like to hear the paper read, and join in the discussion. The chair will be taken by Professor R. G. H. Clements, chairman of the group, at 8 p.m.

Glasgow Section : Chemist in the Food Store

THE opening meeting of the Glasgow Section of the Society of Chemical Industry was held conjointly with the Institute of Chemistry and the Chemical Society in the Royal Technical College, Glasgow, on October 4. The chair was occupied by Mr. J. G. Roberts, and Dr. James Sword gave a paper on "The Chemist in the Food Store."

Introducing the subject, Dr. Sword indicated the changes in conditions which had combined to make the chemist indispensable in the food industries. It was not to be imagined that the usefulness of the food chemist was confined to carrying out tests to ensure that the products complied with regulations. That was an important but relatively small part of his work. Most of his time was occupied on problems connected with the process, and in this he used his chemistry as a background, supplementing it with applications from many other sciences.

In a review of the industries engaged in the manufacture of foodstuffs, Dr. Sword dealt with the part played by the chemist in the production of flour and bread, illustrating from his own industries the problems which had to be considered, and the great influence which the chemist had exerted in the advances which had been made. The other food industries were treated in succession, but more briefly. These included milk, butter, cheese, confectionery, jam, fruit, vegetables, meat, fish (and their subsidiaries), as well as cocoa, coffee and beer. At every stage and in practically every phase of their development the chemist had made his contribution, either independently or in collaboration with other scientists The methods of chance, which had been followed in age-old industries as long as they had been controlled by the art of the operator, had been largely replaced by procedures based on scientific observations.

Speaking of the attitude of the outside world, Dr. Sword said that the food chemist had won his way to recognition and respect against considerable opposition; indeed, he was not yet out of the whins. In spite of the fact that fantastic exaggerations of the cheap Press were frequently published over the names of persons who ought to know better, the lecturer thought that the public was already learning to assign them to their proper place. Official reports could not be so ignored and he thought these were open to criticism when their conclusions were based on statements containing the words "might," "may," and "there is a danger that."

Summing up the position regarding regulations as he saw it, Dr. Sword said that everyone agreed that if the addition of a certain substance in a certain quantity to a foodstuff had been proved deleterious to the health of the consumer, that addition ought to be prohibited, but if it was only a matter of hypothetical possibilities, sentimental notions, conservative prejudices, or even an alleged alteration of nutritive value there should be no interference. If, in any case, good reason existed for such, declaration of the treatment would more than meet the case. As far as was humanly possible the consumer should be left his right of choice.

Referring to the subject of training, Dr. Sword was of the opinion that the food technologist should be first and foremost a chemist, preferably with physics and bacteriology included in his degree, but certainly included in his training. Having completed his degree he should devote a year or more if possible to acquiring a working knowledge of other sciences, sufficient at least to enable him to know his way about in their literatures.

Institution of Chemical Engineers

Hinchley Memorial Lecture

THE Second Hinchley Memorial Lecture, which is to be delivered before the Institution of Chemical Engineers by Sir Harold Hartley, F.R.S., will be upon the subject of "Our National Coal Resources." The lecture will be delivered in the Lecture Theatre of the Institution of Civil Engineers, Great George Street, Westminster, London, S.W.1, on Friday, October 25, at 6.30 p.m., the president, Dr. Herbert Levinstein, presiding. Sir Harold Hartley is vice-president and director of Scientific Research of the London, Midland and Scottish Railway Co. He has been chairman of the Fuel Research Board since 1932, whilst a few months ago he was elected chairman of the British National Committee of the World Power Conference and chairman of its International Executive Council. Non-members of the Institution will be welcome to attend the lecture, tickets being obtainable on application to the assistant secretary.

Institute of Metals

London Section : Gases and Metals

AT a meeting of the London Section of the Institute of Metals held on October 10 a paper was read by Mr. C. J. Smithells entitled "Gases and Metals." In the course of the reading the lecturer said that there were three different aspects of the relations between gases and metals which have been the subject of particular study in recent years. These were the adsorption of gases on the surface of metals, the diffusion of gases through metals, and the actual solubility of gases in metals. Clearly these three phases of the subject were very closely related, but they seemed to have attracted the attention of three quite distinct groups of workers, and the results of their work were not often considered as a whole.

Adsorption of gas on the surface of solid metals was of great importance in industries dealing with high vacua, such as in lamps and valves. There, the important thing was to get rid of all adsorbed gases. It was also of importance in connection with metal powders used as catalysts in many chemical reactions, and had been intensively studied by physical chemists from this point of view. In this case the objective was to encourage the adsorption of the particular gases which were required to react, and avoid the adsorption of poisons which reduce the catalytic activity.

The diffusion of gases through solid metals had been studied by a number of workers, but had not received the attention it deserved in view of the fundamental importance of this process in controlling the amount of gas which went into or came out of metals during melting, casting and annealing operations.

The solubility of gases in metals were equally important from this point of view and was well recognised by most metallurgists. Curiously enough most people had fought shy of making actual solubility measurements. Practically all the data we possessed had been accumumlated in one laboratory—that of Professor Sievert's, at Jena—and only in a few isolated cases had quantitative measurements been made elsewhere.

When these three aspects of the relations of gases and metals were considered as a whole, a much clearer picture of the processes which were occurring in metallurgical practice was obtained. Adsorption was controlled primarily by the chemical nature of the gas and the metal, and secondarily by the physical state of the metal surface. The effect of variations in temperature and pressure had been established and the fundamental nature of the process had been recognised by Langmuir in 1914. The laws of diffusion, and the effect of temperature and pressure had been established by Richar-

son in 1904. Quite recently Smithells and Ransley had shown that adsorption was an essential preliminary to diffusion, and at low temperatures and pressures was the controlling factor. Only those gases which were both adsorbed and dissociated (activated adsorption) by a particular metal could diffuse through it. The difficulty of distinguishing had been surface adsorption, and diffusion into the solid metal was therefore obvious. Whilst as yet there was no law that enables experimenters to predict the actual solubility of a gas in a metal, the effects of temperature and pressure were known, and were found to follow the same laws as in the case of diffusion. In some cases at least the temperature coefficients of diffusion and of solubility were the same. The whole subject of gases and metals was very much to the fore at present, and it was well to consider the bearing of very different fields of research on our knowledge of this subject.

Institute of Chemistry

Liverpool and North-Western Section

THE opening meeting of the Liverpool and North-Western Section of the Institute of Chemistry for the 1935-36 session was held at the Constitutional Club, Liverpool, on October 10, when Mr. A. E. Findley, the retiring chairman, welcomed Mr. B. D. W. Luff as his successor.

In his address entitled "As Others See Us," Mr. Luff dealt with chemists as revealed by the writings of poets, novelists, dramatists and others. He said that it was only in recent years that a body composed of those practising chemistry in one form or another had been at all clearly defined. Prior to the War the attitude of those who gave even passing thought to chemists as we understand them was reflected in a poem of Kipling's in which he referred to those

> "Whose study is of smells,
> And to attentive schools rehearse,
> How something mixed with something else,
> Makes something worse."

The chemist, said Mr. Luff, had provided the complete answer to this taunt in producing objects of beauty from most unpromising materials. One had only to consider the manufacture of artificial silk from such an unpleasant mixture as carbon disulphide, wood pulp, and caustic soda, to realise how far from the truth Kipling really was. The needs of the war, and the industrial reconstruction which followed brought the chemical profession into prominence, and since then the chemist had gradually loomed into the public view, and his place in society had become established.

Arnold Bennett, in his play "Body and Soul" (1922), introduced a character who was described by one of the ladies as "what they call a chemist; not pills and prescriptions. No . . .", suggesting that the public were just awakening to the existence of such an individual although he was apparently something of a novelty since he was not just a chemist but "what they call a chemist." Vicki Baum, however, in "Martin's Summer," made a hero of a chemist whose object in life was to produce a satisfactory non-inflammable cinematograph film, and in this instance we were at last presented with a man, who, although a chemist, was yet capable of experiencing the whole gamut of the emotions.

In the meantime the science itself had not been neglected and many authors had made incursions into chemistry with greater or less success. Occasionally amusing mistakes were made, and more than one writer of mystery stories, including Edgar Wallace, had despatched his victim with the aid of carbon monoxide made from marble and acid. In another story a man who had been overcome by the poisonous vapours given off by some mysterious flowers was revived by having applied to his nose a handkerchief from which there issued "the pungent reek of sal-ammoniac."

A rather amusing lapse was made by "Sapper," who, in a short story in a magazine, made one of his characters chuckle with laughter as he thought of what would happen to some rascal to whom he had given a concentrated solution of calomel. The futility of this must have been brought home to the author, for when the story eventually appeared in book form it was found that a bottle of castor oil had been substituted for the calomel, and it was then realised that his intentions were not as benevolent as might have been imagined from a knowledge of the concentration of a concentrated solution of calomel.

Mr. Luff gave numerous other instances of chemistry being invoked in novels and made special reference to "The Documents in the Case," by Dorothy L. Sayers and R. Eustace, in which the polarimeter was made use of to show that a death which was thought to have been due to the eating of a poisonous fungus was really due to mushrooms doctored with synthetic muscarine. The sample isolated from the remains of a meal was found to be optically inactive, whereas muscarine occurring in the poisonous fungus would be dextro-rotary.

Institute of Fuel

Annual Dinner: Future of the Coal Industry

THE annual dinner of the Institute of Fuel was held on October 9 at the Connaught Rooms, London. Sir John Cadman (president) was in the chair, and there was a company of some 600 members and guests and their ladies. As usual the dinner was followed by dancing and a cabaret.

LORD RUTHERFORD, proposing "Fuel Industries," said that whatever other forms of energy there might be, the chief ones would always be coal and oil. The Institute held meetings and published papers which no doubt were very important, but how much research was being carried out. It was true that we had made improvements in this matter in this country, but we were behind other countries in many respects. We did not hear very much of a gas grid in this country, but it was in operation in other countries. Then there was the generation of electricity by coal and the manufacture of gas. As regards the generation of electricity, the processes at present used resulted in our getting no more than 25 per cent. of the total energy out of the coal, and surely science should be capable of providing an entirely different method which might possibly give an efficiency of nearly 50 per cent. That might be brought about by not using coal but by using another method. Our knowledge of chemical engineering and gaseous reactions at high temperatures and pressures had increased enormously in recent years, and it might be worth while to undertake again those investigations into the gas cell for the generation of electricity which the late Dr. Ludwig Mond was so extraordinarily interested in during the closing years of his life. Eventually, continued Lord Rutherford, he believed we should come back to Old King Coal. We had oil at the present time but, in time, possibly oil would become scarce or at any rate expensive, and then coal would come into its own again and be more than it was to-day, the lifeblood of the industrial life of this country.

The PRESIDENT, in the course of his response to the toast, said he did not disagree with Lord Rutherford when he referred to our wonderful deposits of coal, but he asked whether we were using that fuel in the way it should be used. There had undoubtedly been great advances in the use of electricity and gas but in spite of that the coal fire persisted. One of the greatest difficulties in his view was the structure of the coal industry as a whole manned as it was by a collection of individualists endeavouring to get some united effort covering the whole of the industry. As regards the oil industry, the oil fields of the world were generally speaking in remote parts where it was rather difficult to lay pipes and supply the gas to houses which did not exist. More recently, however, there had been an application of science in developing new methods by which the gas was converted into liquids which could be put into the petrols that came on to the market to give that anti-knock property which was making possible great developments in motor design. At the present time this gas was being converted into benzol and products of that order, and tremendous strides had been made in utilising every available part of the commodity. The application of science to an industry which had within its own hands not only the production but the distribution and the sale of its own products, however, was an advantage which coal had not yet acquired. A great revival was necessary in the coal industry which would have to go through the phase which the oil industry had almost gone through. It was definitely necessary that the coal industry should have at heart the requirements of its customers and he hoped that the Institute of Fuel might become the clearing house and do a great deal in that direction. He assured Lord Rutherford that the sole aim of the Institute of Fuel was to embody the best that could be found in the associated fuel industries, and he

believed the day was not far distant when the Institute would really make itself felt in that particular direction.

The PRESIDENT then presented the Melchett Medal to Mr. Harry R. Ricardo, who had delivered the Melchett Lecture during the afternoon.

Chemical Engineering Group

Chemical Engineering Problems in Paper Making

A MEETING of the Chemical Engineering Group was held at Burlington House, London, on October 11, when Dr. J. L. A. Macdonald, chief chemist to Tullis, Russel & Co., Ltd., paper makers, of Markinch, Fife, dealt with the methods of production and the plant and process problems in the manufacture of paper makers' cellulose, giving special attention to esparto grass papers in which he is particularly interested.

Speaking generally, Dr. Macdonald said that one of the problems facing the paper maker and the chemical engineer at the present time was the fact that the yield of final product from the raw material was about 40 per cent., and therefore something like 60 per cent. of the raw material was wasted. The problem was to recover something useful from that 60 per cent. of waste. Hitherto no great success had been achieved in this direction, but one investigator, in Stockholm, had been working on the problem of the utilisation of alkaline lyes since 1910. The process in general terms was the simple one of the mixing of calcium oxide and barium oxide with a proportion of lye containing so much water and subjecting the mixture to dry distillation. The products were methyl alcohol, acetone, higher ketones and higher alcohols. There were, however, one or two snags in the process. The barium salts were expensive and the problem was to get 100 per cent. barium oxide out of the barium that was present in a mixture of barium carbonate and calcium carbonate. The other problem in connection with lyes from esparto grass was one which hardly seemed to have occurred to anybody. Esparto contained silica, with the result that there was the danger of getting sodium silicate into the calcium/barium oxide mix, and the problem was how to get rid of this.

In answer to questions, the author said an enormous amount of work had been done with bacterial methods for processing cellulosic materials, but the unfortunate thing was that in the case of ligno-cellulose the bacteria went to the cellulose and left the lignin alone. The suggestion had been made that the biologist should be called into this field of the production of cellulose and there was no doubt he would do so in due course. The problem of obtaining the best value out of the organic material had by no means yet been solved. Referring to a comment as to the possibility of a continuous process instead of a batch process in the manufacture of paper makers' cellulose, he said that one firm in Glasgow did take out a patent for a continuous process a few years ago, but the difficulty with regard to esparto grass was that the importation into this country was only about 250,000 tons per annum, and this would not justify the cost of the plant.

Personal Notes

SIR J. W. L. NAPIER has been appointed the new chairman of the Yorkshire Dyeing and Proofing Co., Ltd., following the resignation of Mr. Isaac Swift.

MR. W. CLIFFORD WOOD hasbeen appointed assistant pharmacist at St. Mary, Islington, Hospital. He is an old student of the Leicester College of Technology.

SIR THOMAS HOLLAND will occupy the chair at the Ramsay Chemical Dinner, which is being held this year at the Central Station Hotel, Glasgow, on December 6.

MR. C. T. KINGZETT, of West Byfleet, Surrey, founder of the Sanitas Company, who died last July, left estate of the gross value of £42,932, with net personalty £39,458.

MR. W. B. BROWN has been appointed second secretary to the Board of Trade in succession to Sir Henry Fountain, who is retiring from the public service on October 31. Mr. L. Browett has been appointed to act as deputy to the chief industrial adviser to the Government in succession to Mr. W. B. Brown.

MR. JOHN D. SWAIN has been elected vice-president of Electro Metallurgical Sales Corporation of New York. Mr. Swain has been vice-president of the Linde Air Products Co. and Union Carbide Sale Co., which are other units of the Union Carbide and Carbon Corporation. He has been actively connected with these units for a period of twenty years.

MR. E. R. LINGEMAN, Commercial Secretary at Buenos Aires, is at present in this country on an official visit. Mr. Lingeman will be available at the Department of Overseas Trade on October 28 and 29 for the purpose of interviewing manufacturers and merchants interested in the export of United Kingdom goods to the Argentine Republic. At a later date he will visit a number of industrial centres in the provinces.

MR. F. S. MACGREGOR, managing director of Ducillo, the combined Dupont-I.C.I. Co., which is erecting a big plant at Quilmes, near Buenos Ayres, for the manufacture of rayon, has arrived in Buenos Ayres. Mr. MacGregor said in an interview that when the new plant was operating fully it would employ around 1,000 people. The surveying of the 23 hectare site is already under way, and it is expected that the proposed plant will be inaugurated about the middle of next year. Mr. MacGregor has been visiting the United States to arrange the purchase of the machinery which is to be installed in the new plant.

MR. G. H. HILL has been appointed technical adviser to the Star Paper Mills.

MR. JAMES GRIER has retired from the post of senior lecturer in the department of pharmacy at Manchester University.

DR. J. GRAYMORE, head of the Stockport College, opened a discussion on the new examination regulations at a meeting of the Stockport and District Branch of the Pharmaceutical Society last week.

DR. F. H. CARR, the retiring chairman of the Association of British Chemical Manufacturers, and a director of the British Drug Houses, Ltd., who recently underwent an operation, is now recuperating in Cornwall, and we are glad to learn that he is making good progress.

MR. E. W. SLATTER, of Parkstone, Dorset, and formerly of Shipley, Yorks, chemist to the Saltaire Mills, managing director of W. Lynd and Co., Ltd., and for fifteen years consulting chemist to the Shipley Council, who died on June 22, has left estate of the gross value of £6,683, with net personalty £5,702.

MR. WILLIAM H. WOOLLEY, secretary of the India Tyre and Rubber Co., Inchinnan, Renfrewshire, has been presented with a grandfather clock by his colleagues on the occasion of his leaving the firm to commence business on his own account in London. Mr. Woolley went to Inchinnan from London three years ago and now returns to take up the position of managing director of Business Trusts, Ltd. Mrs. Woolley was made the recipient of a handsome silver cigarette case.

SIR JOHN CUNNINGHAM M'LENNAN, the Canadian physicist, collapsed and died of heart failure while travelling from Paris to Calais in the boat train on the way to London on October 9. Born in Ontario in 1867, he was assistant demonstrator of physics at the University of Toronto from 1892 to 1899 and was demonstrator from 1890 to 1902. In 1907 he became professor of physics at the University and retained this post until 1932, when he was made Professor Emeritus and visiting professor of physics. He was president of the Royal Canadian Institute from 1916 to 1917 and president of the Royal Society of Canada in 1924. In 1928 he was Royal Medallist and Bakerian Lecturer at the Royal Society (London) and was a member of the council and vice-president of the Royal Society from 1933 to 1934. In 1919 he was scientific adviser to the British Admiralty and was a member of the National Research Council of Canada from 1916 to 1931. He received the K.B.E. in June of this year.

Continental Chemical Notes

Russia

PLANS ARE NOW WELL ADVANCED for the commencement of sodium fluoride manufacture on a large scale at Slawjansk.

France

THE SOC. DES PRODUITS SAPRA has been formed in Paris, with a capital of 100,000 francs, and will engage in the manufacture and distribution of insecticides. Other new company registrations include: Merson et Co., 109 Avenue de la République, Châtillon-sous-Bagneux (pharmaceutical products); Gaultier et Neel, 25 rue de Courcelles, Paris (chemical and agricultural products).

Hungary

THE PETER NITROGEN CONCERN plans to erect a factory for manufacturing soda crystals in quantities sufficient to cover the entire home demand; 3.5 million pengo will be invesed in the new enterprise, which will be subsidised by the state.

EFFORTS ARE BEING MADE TO DEVELOP the castor oil industry. The first expressing trials with Hungarian castor seeds have recently been carried out by the vegetable oil works of Leopold Justus and Sohn, at Pécs. Successful cultivation trials are also reported by the Hungaria Artificial Fertiliser Works. Although the price of Hungarian castor oil is above that in the world market, a reduction is expected to follow the extended cultivation now in view. It is also rumoured that the home industry will be further stimulated by the imposition of a protective duty of 24 gold crowns upon each cwt. of imported castor oil.

Germany

A NEW PROCESS FOR HYDROCYANIC ACID MANUFACTURE described by Andrassow ("Angewandte Chemie," 1935, No. 29, p. 471) is based upon reaction between ammonia, methane and air in certain proportions. Under the conditions outlined, no oxides of nitrogen are formed when operating with a platinum catalyst at a temperature of about 1,000° C. Tests with a nickel catalyst revealed the inferiority of this metal to platinum in respect of yield of hydrocyanic acid.

EXPANSION IN FLUORSPAR OUTPUT is anticipated in the Harz district where large deposits of the mineral in a high degree of purity extend to considerable depth. Formerly amounting to 5,000 tons annually (apart from considerable quantities of hydrochloric acid and salts), the production has steadily fallen off in recent years owing to foreign competition. The renewed activity in this field is sponsored by the Rutgerswerke concern, who have purchased a considerable area of suitable land near Siptenfelds.

Lithuania

AN ACETIC ACID FACTORY is about to be constructed at Kovno.

Denmark

THE DANSK FABRIK FOR KODEKSTRAKTER, capital 200,000 kronen, will engage in the manufacture of meat extracts.

THE FIRST LACTIC ACID FACTORY in Denmark is under construction at Olby Lyng, near Koge, by A.S. Sadolin and Holmblad, of Copenhagen.

Spain

CYCLOPENTADECANONE IS A NEW SOLVENT reported by F. Geral "Anal. Soc. Espan. Fis Quim.," 1935, No. 323, p. 438) to offer advantages in micro-determination of molecular weight by the cryoscopic method. It melts at 65.6° C. and its wide solvent powers have enabled the author to use it in determining the molecular weights of such complex organic substances as vitamin D.

Czecho-Slovakia

THREE FIRMS ARE NOW ENGAGED in rayon manufacture, namely: Böhmische Glanzstoff Fabrik, at Labositz-on-Elbe (daily output about 3 tons); Erste Böhmische Kunstseidefabrik A.G., at Theresiental, near Arnau-on-Elbe (daily output likewise about 3 tons); Kunstseidespinnerei A.G., at Senical (daily output reported to be 1 to 2 tons). Shortly to enter into production is also the first plant of the Bata concern at Zlin with an anticipated initial daily output of 1,600 lb.

Far Eastern Chemical Notes

Manchuria

MILLET STALKS WILL BE USED FOR PAPER MANUFACTURE at a factory to be built in Mukden by a new concern, Hoton Itagami K.K. About 6,000 tons paper is the initial output in view.

Japan

PHENOL-FORMALDEHYDE RESIN in sheet form has been put on the market, under the trade name of "Chisso-Rite," by Chosen Sekitan Kogyo K.K.

MANUFACTURE OF SODIUM PEROXIDE, on an initial scale of 20 tons annually, is planned by Yedogawa Kogyosho. Up till now, this article has not been made in Japan.

Forthcoming Events

LONDON

Oct. 21 to 25.—Medical Exhibition. Royal Horticultural Society's New Hall, Westminster, London.

Oct. 25.—Institute of Chemistry (London and South Eastern Counties Section). Dinner-dance. 7 p.m. Strand Palace Hotel, Strand, London.

Oct. 25.—Institution of Chemical Engineers. Second Hinchley Memorial Lecture. "Our National Coal Resources." Sir Harold Hartley. 6.30 p.m. Lecture Theatre of the Institution of Civil Engineers, Great George Street, Westminster, London.

BIRMINGHAM

Oct. 24.—Institute of Metals (Birmingham Section). "The Production and Control of Bronze Castings." Francis W. Rowe. 7 p.m. James Watt Memorial Institute, Birmingham.

GLASGOW.

Oct. 25.—British Association of Chemists (Scottish Section). "Chemistry and Social Evolution." A. Elce. 7.30 p.m. Mackay's Hotel, Glassford Street, Glasgow.

Oct. 25.—Society of Dyers and Colourists (Scottish Section). "A Comparison of some Properties of Woven and Knitted Fabrics." A. J. Hall. 7.30 p.m. St. Enoch Hotel, Glasgow.

LEICESTER

Oct. 23.—Leicester Literary and Philosophical Society. "Treatment and Disposal of Trade Wastes." J. B. Firth. 8 p.m. College of Technology, Leicester.

LIVERPOOL.

Oct. 25.—Society of Chemical Industry (Liverpool Section). "The Alkali Act and its Relation to Chemical Industry." W. A. Damon. 6 p.m. Muspratt Lecture Theatre, The University, Liverpool.

MANCHESTER.

Oct. 21.—Institution of the Rubber Industry (Manchester Section). "The Calender v. The Spreading Machine." E. H. Wallace. 7 p.m. Engineers Club, 17 Albert Square, Manchester.

Oct. 22.—Manchester Literary and Philosophical Society. "Some Early Members of the Manchester Literary and Philosophical Society." Dr. W. H. Brindley. 7 p.m. 36 George Street, Manchester.

Oct. 23.—British Association of Chemists (Manchester Section). Smoking concert. Engineers Club, Albert Square, Manchester.

Oct. 25.—Manchester Literary and Philosophical Society (Chemistry Section). "Some Uncommon Uses of Soap." A. Gill. 36 George Street, Manchester.

OXFORD.

Oct. 26.—The Chemical Society. Joint meeting with the Oxford University Alembic Club. Discussion on "Aromatic Character," opened by Professor R. Robinson, Dr. W. H. Mills, Dr. W. G. Penney and Dr. L. E. Sutton. 2.30 p.m. Department of Biochemistry, The University, Oxford.

Chemical and Allied Stocks and Shares

Current Quotations

THE following table shows this week's Stock Exchange quotations of chemical and allied stocks and shares compared with those of last week. Except where otherwise shown the shares are of £1 denomination.

Name.	Oct. 15.	Oct. 8.
Anglo-Iranian Oil Co., Ltd. Ord.	62/6	61/3
,, 8% Cum. Pref.	34/6	33/-
,, 9% Cum. Pref.	36/6	35/-
Associated Dyers and Cleaners, Ltd. Ord.	2/6	1/10½
,, 6½% Cum. Pref.	5/3¾	4/0¾
Associated Portland Cement Manufacturers, Ltd. Ord.	57/-	56/6
,, 5½% Cum. Pref.	27/-	27/-
Benzol & By-Products, Ltd. 6% Cum. Part Pref.	2/6	2/6
Berger (Lewis) & Sons, Ltd. Ord.	62/6	62/6
Bleachers' Association, Ltd. Ord.	6/10½	5/3
,, 5½% Cum. Pref.	11/3	9/0¾
Boake, A., Roberts & Co., Ltd. 5% Pref. (Cum.)	20/-	20/-
Boots Pure Drug Co., Ltd. Ord. (5/-)	47/9	48/-
Borax Consolidated, Ltd. Pfd. Ord. (£)	97/6	97/6
,, Defd. Ord.	16/9	16/9
,, 5½% Cum. Pref. (£10)	£11	£11
,, 4½% Deb. (1st Mort.) Red. (£100)	£109	£109
,, 4½% 2nd Mort. Deb. Red. (£100)	£104	£104
Bradford Dyers' Association, Ltd. Ord.	8/9	8/1½
,, 5% Cum. Pref.	11/10½	10/7½
,, 4% 1st Mort. Perp. Deb. (£100)	£88	£88
British Celanese, Ltd., 7% 1st Cum. Pref.	25/6	24/6
,, 7½% Part. 2nd Cum. Pref.	22/-	21/3
British Cotton & Wool Dyers' Association Ltd. Ord. (5/-)	5/3	5/-
,, 4% 1st Mort. Deb. Red. (£100)	£90	£90
British Cyanides Co., Ltd. Ord. (2/-)	3/1½	3/-
British Drug Houses, Ltd. Ord.	20/-	20/-
,, 5% Cum. Pref.	21/3	21/3
British Glues and Chemicals, Ltd. Ord. (4/-)	6/3	5/9
,, 8% Pref. (Cum. and Part.)	27/6	27/6
British Oil and Cake Mills, Ltd. Cum. Pfd. Ord.	46/3	46/3
,, 5½% Cum. Pref.	26/3	26/3
,, 4¼% First. Mort. Deb. Red. (£100)	£106/10/-	£107/10/-
British Oxygen Co., Ltd. Ord.	106/3	107/6
,, 6% Cum. Pref.	32/6	32/6
British Portland Cement Manufacturers, Ltd. Ord.	95/-	95/-
,, 6% Cum. Pref.	29/-	29/-
Bryant & May, Ltd. Pref.	67/6	67/6
Burt, Boulton & Haywood, Ltd. Ord.	17/6	17/6
,, 7% Cum. Pref.	27/6	27/6
,, 6% 1st Mort. Deb. Red. (£100)	£105/10/-	£105/10/-
Bush, W. J., & Co., Ltd. 5% Cum. Pref. (£5)	108/9	108/9
,, 4% 1st Mort. Deb. Red. (£100)	£96/10/-	£96/10/-
Calico Printers' Association, Ltd. Ord.	8/9	7/6
,, 5% Pref. (Cum.)	12/6	12/6
Cellulose Acetate Silk Co., Ltd. Ord.	12/6	12/6
,, Deferred (1/-)	2/1½	2/1½
Consett Iron Co., Ltd. Ord.	11/-	11/-
,, 8% Pref.	27/6	27/6
,, 6% First Deb. stock, Red. (£100)	£106	£106
Cooper, McDougal & Robertson, Ltd. Ord.	32/6	32/6
,, 7% Cum. Pref.	28/9	28/9
Courtaulds, Ltd. Ord.	53/1½	53/1½
,, 5% Cum.	25/-	25/-
Crosfield, Joseph, & Sons, Ltd. 5% Cum. Pre Pref.	25/-	25/-
,, Cum. 6% Pref.	28/9	28/9
,, 6½% Cum. Pref.	29/4½	29/4½
,, 7½% "A" Cum. Pref.	30/-	30/-
Distillers Co., Ltd. Ord.	91/-	90/-
,, 6% Pref. Stock Cum.	30/6	29/9
Dorman Long & Co., Ltd. Ord.	19/6	19/9
,, Prefd. Ord.	28/6	30/-
,, 6½% Non-Cum. 1st Pref.	22/6	22/3
,, 8% Non-Cum. 2nd Pref.	20/9	20/3
,, 4% First Mort. Perp. Deb. (£100)	£102/10/-	£102/10/-
,, 5% 1st Mort. Red. Deb. (£100)	£103	£102

Name.	Oct. 15.	Oct. 8.
English Velvet & Cord Dyers' Association, Ltd. Ord.	4/4½	4/4½
,, 5% Cum. Pref.	8/9	8/9
,, 4% First Mort. Deb. Red. (£100)	£70	£70
Fison, Packard & Prentice, Ltd. Ord.	38/9	38/1½
,, 7% Non-Cum. Pref.	31/3	31/3
,, 4½% Debs. (Reg.) Red. (£100)	£107	£107
Gas Light & Coke Co., Ord.	26/6	26/3
,, 3½% Maximum Stock (£100)	£90	£90
,, 4% Consolidated Pref. Stock (£100)	£106/10/-	£106/10/-
,, 3% Consolidated Deb. Stock, Irred. (£100)	£86	£86
,, 5% Deb. Stock, Red. (£100)	£116	£116
,, 4½% Red. Deb. Stock (1960-65) (£100)	£114	£114
Goodlass Wall & Lead Industries, Ltd. Ord. (10/-)	13/1½	13/1½
,, 7% Prefd. Ord. (10/-)	13/1½	13/1½
,, 7% Cum. Pref.	30/-	30/-
Gossage, William, & Sons, Ltd. 5% 1st Cum. Pref.	24/4½	24/4½
,, 6½% Cum. Pref.	30/-	30/-
Imperial Chemical Industries, Ltd. Ord.	34/9	34/9
,, Deferred (10/-)	8/6	8/3
,, 7% Cum. Pref.	32/3	31/9
Imperial Smelting Corporation, Ltd. Ord.	15/6	14/-
,, 6½% Pref. (Cum.)	24/3	23/9
International Nickel Co. of Canada, Ltd. Cum.	$32	$31⅝
Johnson, Matthey & Co., Ltd. 5% Cum. Pref. (£5)	105/-	105/-
,, 4% Mort. Deb. Red. (£100)	£98/10/-	£98/10/-
Laporte, B., Ltd., Ord.	110/-	108/9
Lawes Chemical Manure Co., Ltd. Ord. (1/-)	6/3	6/3
,, 7% Non-Cum. Part Pref. (10/-)	10/-	10/-
Lever Bros., Ltd. 7% Cum. Pref.	30/6	30/-
,, 8% Cum. "A" Pref.	31/-	31/-
,, 20% Cum. Prefd. Ord.	76/10½	76/10½
,, 5% Cons. Deb. (£100)	£106	£106
,, 4% Cons. Deb. (£100)	£103	£103
Magadi Soda Co., Ltd. 12½% Pref. Ord. (5/-)	1/3	1/3
,, 6% 2nd Pref. (5/-)	6d.	6d.
,, 6% 1st Debs. (Reg.)	£40	£40
Major & Co., Ltd. Ord. (5/-)	7½d.	7½d.
,, 8% Part. Prefd. Ord. (10/-)	9d.	9d.
,, 7½% Cum. Pref.	11¼d.	1/3
Pinchin, Johnson & Co., Ltd. Ord. (10/-)	42/-	38/6
,, 1st Pref. 6½% Cum.	30/-	33/1½
Potash Syndicate of Germany (Deutsches Kalisyndikat G.m.b.H.) 7% Gld. Ln. Sr. "A" and "B" Rd.	£67/10/-	£64/10/-
Reckitt & Sons, Ltd. Ord.	108/1½	107/6
,, 4½% Cum. 1st Pref.	25/-	25/-
Salt Union, Ltd. Ord.	40/-	40/-
,, Pref.	46/3	46/3
,, 4½ Deb. (£100)	£109/10/-	£109/10/-
South Metropolitan Gas Co. Ord. (£100)	£122/10/-	£122/10/-
,, 6% Irred. Pref. (£100)	£149/10/-	£149/10/-
,, 4% Pref. (Irred.) (£100)	£107	£107
,, Perpetual 3% Deb. (£100)	£86	£86
,, 5% Red. Deb. 1950-60 (£100)	£115/10/-	£115/10/-
Staveley Coal & Iron Co., Ltd. Ord.	47/6	46/10½
Stevenson & Howell, Ltd. 6½% Cum. Pref.	26/3	26/3
Triplex Safety Glass Co., Ltd. Ord. (10/-)	73/1½	71/3
Unilever, Ltd. Ord.	28/9	27/6
,, 7% Cum. Pref.	27/9	27/9
United Glass Bottle Manufacturers, Ltd. Ord.	39/-	38/-
,, 7½% Cum. Pref.	33/-	33/-
United Molasses Co., Ltd Ord. (6/8)	18/9	18/9
,, 6% Cum. Pref.	25/-	25/-
United Premier Oil & Cake Co., Ltd. Ord. (5/-)	7/6	7/3
,, 7% Cum. Pref.	24/4½	23/9
,, 6% Deb. Red. (£100)	£101	£101

Inventions in the Chemical Industry

Patent Specifications and Applications

THE following information is prepared from the Official Patents Journal. Printed copies of Specifications accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

Complete Specifications open to Public Inspection

ALKALI METAL CARBONATES, production.—Mathieson Alkali Works. April 6, 1934. 13023/34.

AZO DYESTUFFS, manufacture.—J. R. Geigy, A.-G. April 7, 1934. 7810-35.

STABILISING CHLORINATED RUBBER.—Deutsche Gold-und Silber-Scheideanstalt Vorm. Roessler. April 3, 1934. 7977/35.

TITANIUM STEEL, producing.—W. Mathesius. April 7, 1934. 10208/35.

ALKALI NITRATE, production.—I. G. Farbenindustrie. April 7, 1934. 10236/35.

COPPER SULPHATE, manufacture.—M. Serciron. April 7, 1934. 10360/35.

SEPARATION OF THE ACYLATABLE CONSTITUENTS of a substance mixture.—Schering-Kahlbaum A.-G. April 6, 1934. 10497/35.

PRODUCING COLOURED RESISTS in dyeing with ester salts of leuco-vat-dyestuffs.—Durand and Huguenin A.-G. April 7, 1934. 10594/35.

ACYLATED POLYALKYLENE POLYAMINES, preparation.—I. G. Farbenindustrie. April 7, 1934. 10727/35.

MAKING FORMALDEHYDE and other oxidation products from hydrocarbons of the paraffin series having more than one carbon atom in the molecule.—Gutehoffnungschütte Oberhausen A.-G. April 7, 1934. 10842/35.

GELATINE PRODUCTS and the like and their manufacture.—Deutsche Hydrierwerke A.-G. April 7, 1934. 10843/35.

ESTERS OF POLYCYCLIC ALCOHOLS, manufacture.—Schering-Kahlbaum A.-G. April 7, 1934. 10877/35.

Specifications Accepted with Date of Application

FIXATION OF DYESTUFFS on textile fibres.—Calico Printers' Association, Ltd., L. A. Lantz and A. L. Morrison. Dec. 22, 1933. 435,868.

ALKYL CHLORIDES, and/or alkyl bromides, from olefines or mixtures containing olefines, manufacture.—E. H. Strange and T. Kane. March 1, 1934. 435,858.

GLYCEROL ETHERS.—Imperial Chemical Industries, Ltd., A. W. Baldwin I. M. Heilbron, and W. E. Jones. March 5, 1934. 436,143.

ORGANIC COMPOUNDS containing alkyl radicles of high molecular weight, manufacture and production.—J. Y. Johnson (I. G. Farbenindustrie). March 26, 1934. 435,863.

COMPLEX COMPOUNDS of alkali-and alkaline-earth metal halides with amines, manufacture.—I. G. Farbenindustrie. April 1, 1933. 436,008.

CELLULOSE FROM LIGNOCELLULOSIC MATERIALS, manufacture.—British Celanese, Ltd., W. H. Groombridge and E. V. Mellers. April 4, 1934. 436,090.

N-DICHLORO-AZO-DICARBON-AMIDINE, process of making.—Wallace and Tiernan Products, Inc. March 17, 1934. 436,093.

AZO DYESTUFFS, process for the manufacture.—A. Carpmael (I. G. Farbenindustrie). April 4, 1934. 436,095.

DYESTUFFS of the gallocyanine series, manufacture.—I. G. Farbenindustrie. April 5, 1933. 436,096.

NITROCELLULOSE PLASTICS and methods for the production thereof. H. J. Tattersall and Imperial Chemical Industries, Ltd. April 6, 1934. 436,161.

HETEROCYCLIC COMPOUNDS, manufacture.—A. Carpmael (I. G. Farbenindustrie). Sept. 19, 1934. 436,110.

TREATMENT OF BENZOLS, petrols and other hydrocarbons, process. Soc. Anon. D'Ougree Marihaye. Nov. 10, 1934. 435,965.

2-KETOLAEVO-GULONIC ACID, process for the manufacture.—F. Hoffman-La Roche and Co., A.-G. March 15, 1934. 435,971.

STABLE PREPARATIONS of compounds containing active halogen, manufacture.—Chemische Fabrik von Heyden A.-G. Jan. 19, 1934. 436,054.

ASYMMETRIC DICHLORETHYLENE or 1-1-dichlorethene, preparation. Compagnie de Produits Chimiques et Electrometallurgiques Alais, Froges, et Camargue. May 26, 1934. 436,133.

Applications for Patents

(September 26 to October 2 inclusive).

CYCLOHEXENYLAKYLHYDANTOINS, manufacture. — Chemical Works, formerly Sandoz. (Switzerland, Oct. 8, '34.) 27099.

RESINS, ETC., manufacture.—Deutsche Hydrierwerke A.-G. (Germany, Sept. 27, '34.) 26790.

ESTERS OF CARBOCYCLIC ACIDS, ETC.—E. I. du Pont de Nemours and Co. 27087.

SYNTHETIC RESIN PRODUCTS.—C. S. Farmer. 26984.

PREPARING HIGHER LACTONES.—Firmenich and Cie. (Germany, Sept. 28, '34.) 27004.

SEPARATING SOLIDS FROM SUSPENSION in gases.—Goodlass Wall and Lead Industries, Ltd., and H. Waring. 26632.

SOLUTIONS OF POLYMERISATION PRODUCTS, manufacture.—W. W. Groves (I. G. Farbenindustrie). 26649.

AROMATIC COMPOUNDS, manufacture.—W. W. Groves (I. G. Farbenindustrie). 26650.

TRIFLUOROMETHYLARYLSULPHONIC ACIDS, manufacture.—W. W. Groves (I. G. Farbenindustrie.) 27084.

BITUMINOUS MATERIALS, ETC., manufacture.—J. Henke. 27095.

SOLID WATER-SOLUBLE ALUMINIUM ACETATE, manufacture.—T. Hennig. 27079.

N-ARYLGLUCAMINES, manufacture.—F. Hoffmann-Lt Roche and Co. A.-G. (Germany, Nov. 8, '34.) 26954.

POLYCYCLIC COMPOUNDS FROM CHRYSENE, manufacture.—I. G. Farbenindustrie. (Germany, Sept. 27, '34.) 26755.

Prices of Chemical Products

Current Market Conditions

PRICE changes which have occurred during the week are given below. Apart from these items the prices of all chemical products remain as reported in THE CHEMICAL AGE last week. Unless otherwise stated the prices quoted cover fair quantities net and naked at sellers' works.

LONDON.—There is a steady tone ruling in all markets with the demand for most products satisfactory and the undertone continues strong. The coal tar products market remains firm, and there are no changes in prices to report from last week.

MANCHESTER.—Rather more activity has been reported in some sections of the Manchester chemical market during the past week and here and there increased interest in contract commitments has been experienced, with some expansion in the volume of business for early delivery. In a measure this is believed to be due to anxieties arising from the international crisis. On the other hand, better reports have been forthcoming during the past week regarding conditions in the cotton textile industry and if the improvement is maintained chemicals will benefit from an increased demand for the materials used in the dyeing and finishing trades. The price position keeps generally firm. In the light sections of the by-products trade, in particular, the heavier business during recent weeks has been reflected in rather substantial price advances, and in the other sections the undertone has been somewhat steadier than it was not long ago.

SCOTLAND.—There has been an improved demand for chemicals for home trade during the week, and also more inquiry for export. Prices generally continue very firm at about previous figures. Lead, zinc and copper products are all dearer in sympathy with advances in metal prices. Red lead, litharge and white lead have advanced a further £2 per ton.

Price Changes

General Chemicals.—ACID, citric (Manchester), 11¾d. to 1s. per lb.; ARSENIC (London), £15 per ton, c.i.f., main U.K. ports for imported material; (Manchester), white powdered Cornish, £22 ex store; LEAD ACETATE (Manchester), white, £37 per ton; brown, £34 10s.; POTASSIUM PERMANGANATE (Manchester), B.P. 1s. per lb.; SULPHATE OF COPPER (Manchester), £14 7s. 6d. per ton, f.o.b.; LEAD NITRATE, £32 10s. to £34 1/s. per ton.

Rubber Chemicals.—VERMILION, pale or deep, 4s. 8d. per lb.

Wood Distillation Products.—CHARCOAL, £4 15s. to £10 per ton; METHYL ACETONE, 40/50%, £43 to £46 per ton; WOOD CREOSOTE, unrefined, 3d. to 1s. 3d. per gal.; WOOD TAR, £2 to £2 10s. per ton.

Coal Tar Products.—NAPHTHALENE, purified crystals, £11 per ton; TOLUOL, 90%, 2s. to 2s. 1d. per gal.; pure, 2s. 4d. to 2s. 5d. per gal.; XYLOL, 2s. to 2s. 1d. per gal.; pure, 2s. 3d. to 2s. 4d. per gal.

Pharmaceutical and Photographic Materials.—ACID, BENZOIC, B.P., 1s. 10½d. to 1s. 11d. per lb.; BISMUTH SALTS: Carbonate, 6s. 6d.; citrate, 9s. 8d.; nitrate (cryst), 4s. 7d.; oxide, 10s. 8d.; salicylate, 7s. 11d.; subchloride, 10s. 5d.; subgallate, 7s. 7d.; subnitrate, 5s. 8d.; MENTHOL, A.B.R. recryst., B.P., 14s. 6d.

Essential Oils.—BERGAMOT, 8s. 3d. per lb.; BOURBON GERANIUM, 23s.; CINNAMON OIL, Ceylon, 3s. 4d.; LEMONGRASS, 3s.; PEPPERMINT, Japanese, 6s. 6d.; Wayne County, 10s.; PETITGRAIN, 5s. 3d.

From Week to Week

MR. W. A. DAWSON, chief alkali inspector, will present a paper on "The Alkali Act and its Relation to the Chemical Industry," at a meeting of the Liverpool section of the Society of Chemical Industry on October 25.

THE NATIONAL FIRE PROTECTION CO., LTD., has just issued a new catalogue of fire fighting appliances. The company is turning out 500 methyl bromide extinguishers per week for the Air Ministry and is also supplying other larger contracts.

IMPORTS OF CHEMICALS into the Irish Free State during August totalled £86,912, an increase on the corresponding period of last year when the import figures were £69,495. Chemical fertiliser imports also increased, the value in August, 1935, being £13,743, against £8,627 in the same month of 1934.

THE PROPOSED ERECTION by a Swiss firm of a silk factory at Sherborne, at which 300 persons would be employed, has been abandoned. In announcing this decision to the local authority the firm states: "In view of the political international confusion, which obliges us to be careful, we regret deeply that this matter, for which we had brought great sacrifice, has taken this issue."

A MEETING of the Institute of Chemistry, South Wales Section, will be held jointly with the local sections of the Chemical Society, Society of Chemical Industry, Institute of Metals, Institute of Petroleum Technologists and the University College of Swansea Chemical Society, at the Hotel Metropole, Swansea, on October 25. Professor Jocelyn F. Thorpe, President of the Institute of Chemistry, will give an address on "The Chemist." After the meeting a dinner will be held to celebrate the Charter Jubilee of the Institute of Chemistry.

THE INTERNATIONAL TIN COMMITTEE will meet at The Hague on Wednesday, October 23, to consider the tin situation and the advisability of a quota alteration. In the meantime, stocks are being shipped from Holland to relieve the tight position in this country. It is understood that about 500 tons will arrive in the near future. The September stock figures showed a carry-forward at the Arnhem smelter in Holland of approximately 2,000 tons. It is probable that the major proportion of this will be shipped to the British market should the tight position continue.

PETROLEUM REFINING was carried on in Canada last year in forty-two separate plants, with a total capitalisation of $66,450,496, and employing 4,876 persons earning in all $6,274,799. The Canadian output of gasoline, fuel oil and other refined petroleum products was valued at $76,242,914, as compared with $70,268,265 a year previously, and of the 1934 total products of the petroleum refining plants were valued at $75,691,078, the balance of $551,836 being made up of the output of the nine plants manufacturing lubricating oils and greases. These nine plants had a total capitalisation of $570,545, with 81 employees earning during the year $104,427.

THE DIRECTORS of Coal and Allied Industries, Ltd., in a circular to shareholders, announce that the large-scale plant at Seaham Harbour was put into initial operation on September 21. In accordance with the usual procedure a number of trial runs have been and are being made. The results from these trial tests confirm in all respects the opinion previously expressed by the board that the plant will operate successfully. With regard to the marketing of the products, an agreement has been entered into with Dinham, Fawcus and Co., Ltd., for the disposal of the semi-coke production, and the sale and distribution of the chemicals is being undertaken by Atlantic Chemicals, Ltd., a subsidiary of Coal and Allied Industries, Ltd.

A COMMITTEE, under the chairmanship of Sir Harry McGowan, is making arrangements for a banquet to mark the progress of research in industry during the twenty-five years of the King's reign. A gathering of 800 leaders in industrial research is anticipated on November 22, at the Connaught Rooms. The guest of honour will be the Lord President of the Council. By virtue of his office, Mr. Ramsay Macdonald is responsible for the Department of Scientific and Industrial Research, and the banquet will present an opportunity for him to meet those concerned with the finance, direction, and organisation of every sphere of research in British industry. Members of the executive committee include: Sir Andrew Duncan and Sir David Milne-Watson, with Mr. W. U. J. Woolcock and Dr. E. W. Smith as honorary secretaries.

AN EXPERIMENT AT COURTAULDS' WORKS was described to Mr. Justice Clauson in the Chancery Division on October 10, during the continued hearing of the action by British Celanese, Ltd., of Stowmarket, Suffolk, Mr. Edward Maloney, a receiver for debenture-holders in British Acetate Silk, and Hillier, Parker, May and Rowden, the London auctioneers. The matter immediately before the court was the claim by British Celanese that their "funnel" patent had been infringed. Defendants denied infringement, and pleaded that the patent was invalid. Mr. H. A. Gill, consulting engineer and patent expert, who gave evidence in the litigation between the plaintiffs and Courtaulds in relation to other patents, said that during the week-end 100 per cent. flat filaments and 100 per cent. bulbous had been produced experimentally at Courtaulds' works with an apparatus which, in his view, tested the patent taken out by Bouffe in 1921.

THREE WORKMEN WERE KILLED and five seriously injured when an oxygen apparatus exploded in a naval shipyard at St. Nazaire on October 11. The men were working on the construction of the battleships Strasburg and Georges-Leygues.

THE PRESENTATION OF THE LEVERHULME PRIZE will take place at the opening meeting of the Liverpool section of the Society of Chemical Industry, which will be held in the Muspratt Lecture Theatre of Liverpool University on October 25.

THE ELEVENTH ANNUAL NORMAN LOCKYER LECTURE of the British Science Guild will be given by Sir Josiah Stamp, who has chosen as his subject "The Calculus of Plenty." The lecture will be given in the Goldsmiths' Hall (by permission of the Goldsmiths' Company) on November 13, at 4.30 p.m.

THE NOMINAL CAPITAL of C. C. Fuels, Ltd., manufacturers of artificial fuels, etc., Imperial House, Kingsway, W.C., has been increased by the addition of £8,400 beyond the registered capital of £100. The additional capital is divided into 8,000 5 per cent. non-cumulative redeemable preference shares of £1 and 8,000 ordinary shares of 1s. each.

EMPLOYMENT AND WAGES have improved in the St. Helens glass trade during the past few weeks. Following the recent increase of wages given to the employees at Pilkington's four glass works, between 500 and 600 engineers and maintenance men employed at the Sherdley works of the United Glass Bottle Manufacturers, Ltd., and at Forster's works at Pocket Nook, have each received an increase of 3s. per week. Last week-end an additional tank and bottle-making shop was brought into use at the Ravenhead works of the U.G.B., and this has taken about 200 people off the books of the labour exchange.

AT CARNARVONSHIRE ASSIZES on Tuesday, before Mr. Justice Lawrence, Frederick Victor Carl Koch (30), chemist, an inmate of a mental home at Llanfairfechan, was charged on a Coroner's warrant with the murder of his friend, Dr. Ronald S. Morgan, a doctor of chemistry on the research staff of Lever Bros. at Port Sunlight, whose battered body was found on the beach at Llanfairfechan last Sunday week. The only evidence called was that of Dr. Murdock, medical officer of Walton Prison, who said the accused was not fit to plead as he was suffering from disease of the mind. The prisoner was ordered to be detained during his Majesty's pleasure.

TWO DEATHS resulted from an explosion following a fire in an experimental department of the chemical works of Spencer Chapman and Messel, Ltd., at Silvertown, London, on Wednesday. The dead men were James Burton, of Sussex Road, East Ham, and A. G. Ricketts, of Periton Road, Eltham. J. Whittingstall (19), of Beaconsfield Road, East Ham, who was less seriously hurt, is detained in the hospital. At the time of the explosion the three men were said to be repairing a large paraffin tank. Suddenly one of the tanks burst into flames. There were several explosions, followed by a sheet of flame. Firemen confined the fire to a paraffin distillery and the main buildings were not affected.

THE INSTITUTE OF LABOUR MANAGEMENT is arranging a dinner at the Mayfair Hotel, Berkeley Square, London, on October 25, 1935, when Lord Melchett, Imperial Chemical Industries, Ltd., is speaking on "Industrial Relations." The Institute invites all interested to be present on this occasion, as it believes that the more effective adjustment of industrial relationships is essential to the full development of industry in the future. Other speakers will include: Mr. W. Gledhill, M.P., managing director of Gledhill-Brook Time Recorders, Ltd., and chairman of the Confederation of Management Associations; Mr. H. J. Clarke, director of Selfridge and Co., Ltd., and Mr. J. H. Fullwood, employment manager, Peek, Frean and Co., Ltd., and president of the Institute of Labour Management. Tickets, £1 each, can be obtained from Miss O. D. Spicer, secretary, Terminal House, 52 Grosvenor Gardens, London, S.W.1.

IN THE CHANCERY DIVISION on Wednesday, Mr. Justice Clauson reserved judgment in the action brought by British Celanese, Ltd., against the British Acetate Silk Corporation, Ltd., of Stowmarket Suffolk; Mr. Edward Maloney, a receiver for debenture holders in that company; and Hillier, Parker, May and Rowden, the London auctioneers. Though the action relates to the "pump" and the "funnel" patents for spinning rayon, the chief contest has been over the latter. The British Acetate Silk Corporation had admitted some infringement of the pump patent, and his Lordship had intimated that he was prepared to grant a certificate that it was valid. So far as the funnel patent is concerned, the British Acetate Silk Corporation admitted that for a time they used some machine fitted with a funnel device, but they pleaded that the patent was invalid. The other defendants denied that there had been any infringement on their part. Mr. K. E. Shelley (for defendants) submitted that the funnel patent was invalidated by anticipation and by ambiguity in the specification. Mr. A. Grant, K.C. (for plaintiffs) submitted that there was no ambiguity, because the specification was quite clear to anyone in the industry. It solved an important problem with which the alleged anticipation did not attempt to deal.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

Mortgages and Charges

(NOTE.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

BRITANNIA LEAD CO., LTD., London, E. C. (M., 19/10/35.) Reg. Oct. 7, £300,000 (not ex.) secured by letter of credit, to Hambros Bank, Ltd.; charged on certain silver-lead bullion, etc., ranking in priority to deb. dated Apr. 19, 1932. *$1,000,000. Oct. 5, 1934.

COXETER AND SON, LTD., London, N.W., mfrs. of scientific instruments, etc. (M., 19/10/35.) Reg. Oct. 8, £17,000 debs. with 5 per cent. premium; general charge. *Nil. Aug. 2, 1934.

EAST LANCASHIRE CHEMICAL CO., LTD., Manchester. (M., 19/10/35.) Reg. Oct. 5, £2,500 (not ex.) and £2,500 (not ex.) charges, to Lloyds Bank, Ltd.; charged on properties at Droylsden, etc. *£15,000. June 4, 1935.

FILTRATORS, LTD., London, W.C. (M., 19/10/35.) Reg. Oct. 3, £3,000 debs., part of £20,000 already reg. *£11,000. Jan. 12, 1935.

Satisfactions

VISCO ENGINEERING CO., LTD., Croydon. (M.S., 19/10/35.) Satisfaction reg. Oct. 5, of mort. reg. June 15, 1932.

Company Winding-Up

THE J. M. NEWTON VITREO-COLLOID (1928), LTD. (C.W.U., 19/10/35.) Mr. W. R. T. Whatmore, 11 Ironmonger Lane, E.C.2, appointed liquidator. Sept. 27, 1935.

Company News

Burmah Oil Co.—The directors have decided to maintain the interim dividend on the ordinary shares at 3¾ per cent., less tax.

Babcock and Wilcox.—An interim dividend of 4 per cent. is announced on the ordinary shares. This is the same as last year, when a final distribution at the same rate increased the total dividend to 8 per cent., against 6 per cent. in 1933.

Fison Packard and Prentice.—The payment of a final dividend is announced on the ordinary shares ranking, o'f 6½ per cent., less tax, making 9 per cent. for the year to June 30, 1935. This compares with a total of 7½ per cent. for the previous year.

British Celanese, Ltd.—The directors decided to pay on October 31, to holders registered as at the close of business on October 15, a full year's dividend on the 7 per cent. first cumulative preference shares, bringing the dividend paid on this class of share up to April 30, 1934.

Sadler and Co.—The report for the year to June 30 last shows trading on profit £11,592 (against £7,764); interest on investments, etc., £7,919 (against £8,126); add £3,856 brought in, making £23,376; to depreciation, £7,500; final dividend 4½ per cent., less tax, making 7 per cent. (against 6 per cent.); forward, £3,011.

Chemical Bank and Trust Co., New York.—The balance sheet as at September 30, 1935, shows assets totalling $574,111,764, chief items being cash and due from banks $131,027,010, U.S. Government obligations $189,853,709' ' State and Municipal Bonds $9,519,871, loans and discounts $92,628,018. Capital, surplus and undivided profits stand at $69,606,666 and deposits amount to $486,3184,381.

Bryant and May, Ltd.—An interim dividend of 10 per cent., tax free has been declared on the ordinary shares and an interim dividend of 5 per cent., tax free, on the partnership shares for the half-year to September 30 last. A year ago the ordinary interim dividend was only 6 per cent., the payment for the full year totalling 25 per cent. A bonus dividend of 18 31-33 was also distributed.

Explosives and Chemical Products.—The net profit to June 20, after providing for depreciation, taxation and contingencies, and for remuneration of directors amounted to £15,940, against £15,001 in the previous year, plus £27,074 brought in, leaving £43,013. Dividend on ordinary at 16⅔ per cent., free of tax, in proportion to amounts paid up at date of balance sheet, and dividend on deferred of 5.9124d. per share, free of tax absorb £10,131, leaving £32,882.

Midland Tar Distillers.—The report for the year to June 30 last shows profit, including interest of investments, of £44,588 (against £43,128); payment of 6 per cent. preference dividend absorbs £5,536; final dividend on ordinary shares of 2½ per cent., tax free, making 5 per cent. (same), £19,085; to obsolescence and depreciation reserve £12,500; to general reserve, £5,000; leaving to go forward, £22,078, against £19,610 brought in.

The Electrolytic Zinc Co. of Australasia.—A preliminary statement for the year ended June 30 last has been issued showing that net profit, after providing £145,000 for amortisation and depreciation and £55,923 for taxation, was £256,020. The net profit for the preceding period was £234,797. A dividend of 5 per cent. was announced in July last for the year to June 30, 1935, comparing with 4 per cent. for the previous year.

Burt, Boulton and Haywood, Ltd.—For the year to June 30, the net profit is £19,582, compared with £43,739 in 1933-34. This figure is after providing a reserve for losses on subsidiaries and contingencies of £32,121, of which £25,000 is transferred from reserve. Adding to the profit £9,364 brought in, there is £28,946 available (against £38,612), of which preference dividends absorb £8,137 and workers' distribution £205. Proposed final dividend is 2 per cent., making 4 per cent. for the year (against 5 per cent.) on the ordinary shares absorbing £16,113 for the year, and 2 per cent. is payable on workers' certificates, leaving to go forward £4,291.

Chemical Trade Inquiries

The following trade inquiries are abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).

British India.—A Parsi firm of agents and importers established at Bombay wishes to obtain the representation, on a commission basis, of United Kingdom manufacturers of chemicals for the Bombay Presidency. (Ref. No. 347.)

Canada.—A manufacturers' agent with headquarters in Montreal wishes to obtain the representation, on a commission basis, for the Provinces of Quebec and Ontario, of United Kingdom manufacturers of sulphate of copper, carbonate of magnesia, French ochre, barytes and chemicals for the paint and rubber industries. (Ref. No. 349.)

Austria.—An agent established at Vienna wishes to obtain the representation, on a buying and commission basis, of United Kingdom manufacturers of cosmetic preparations, pharmaceutical specialities, photographic articles, etc. (Ref. No. 356.)

Austria.—An agent established at Vienna wishes to obtain the representation, on a commission basis, of United Kingdom manufacturers of chemicals for the textile and paper industries. (Ref. No. 358.)

Egypt.—The Commercial Secretary to the Residency, Egypt, reports that the Ministry of Agriculture is cabling for tenders, to be presented in Egypt by December 11, 1935, for the supply of laboratory apparatus. (Ref. T.Y. 10158.)

Egypt.—The Commercial Secretary to the Residency, Egypt, reports that the Egyptian Ministry of Public Works is calling for tenders, to be presented in Cairo by November 2, 1935, for the supply of paints, varnish, etc. (Ref. T.Y. 114.)

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